ARMY ORDNANCE

THE JOURNAL OF THE ARMY ORDNANCE ASSOCIATION

Founded 1920

Pledged to Industrial Preparedness as Our Strongest Guaranty of Peace

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THE ARMY ORDNANCE ASSOCIATION

The Aims, Purposes, and National Officers of the Society

THE Army Ordnance Association is a national organization of American citizens pledged to industrial preparedness for war as our nation's strongest guaranty of peace.

The Association endeavors to keep alive an interest in and knowledge of the design, production and maintenance of munitions. Other than a few manufacturing arsenals—six in all—there is no peace-time industry for the production of ordnance. Should war unhappily come again, industrial America will be called upon to produce munitions in great quantity and of intricate and unusual design. In an emergency, time will not permit careful study or long preparation for the production of munitions. The problem is one of vital concern.

The Army Ordnance Association believes that the solution of this problem, based on experience, lies in an active organization at all times coöperating with the Government. The principal objective of the Association is an active membership of American citizens, on whom the duty of design and production of munitions will fall in war, who will have an accurate and authentic knowledge of the complex requirements of ordnance. "Peace insurance" in this form is the foremost aim of the Army Ordnance Association.

The Association is devoted solely to the national defense; it has no commercial interests, no political alliances, and no religious affiliations. It is not operated for profit: its income is expended in furthering its aims. Its officers and directors serve without remuneration. Membership, to which American male citizens are eligible, is four dollars a year. (Application on request.)

ARMY ORDNANCE, the journal of the Association, is published solely for the purpose of disseminating information on the progress of our munitions developments so that American industry may at all times know its responsibilities to the common defense.

The objectives of the Association as set forth in its Constitution are:

To assist in effecting industrial preparedness for war as being one of the nation's strongest guaranties of peace;

To keep available the highly specialized knowledge necessary for arming the manhood of the nation by stimulating interest in the design and production of ordnance material;

To promote mutual understanding and to effect coöperation with American scientists, inventors, engineers and manufacturers in civil life and the Regular and Reserve officers of the Ordnance Department;

To provide, when required, the services of competent committees to investigate and report upon special ordnance subjects;

To assist in developing and maintaining an efficient personnel, both commissioned and enlisted, for the units required for Ordnance Field Service in the event of an emergency;

To commemorate the services rendered by the industry of the nation and by the officers and civilian employees of the Ordnance Department in the wars in which the United States has been engaged.

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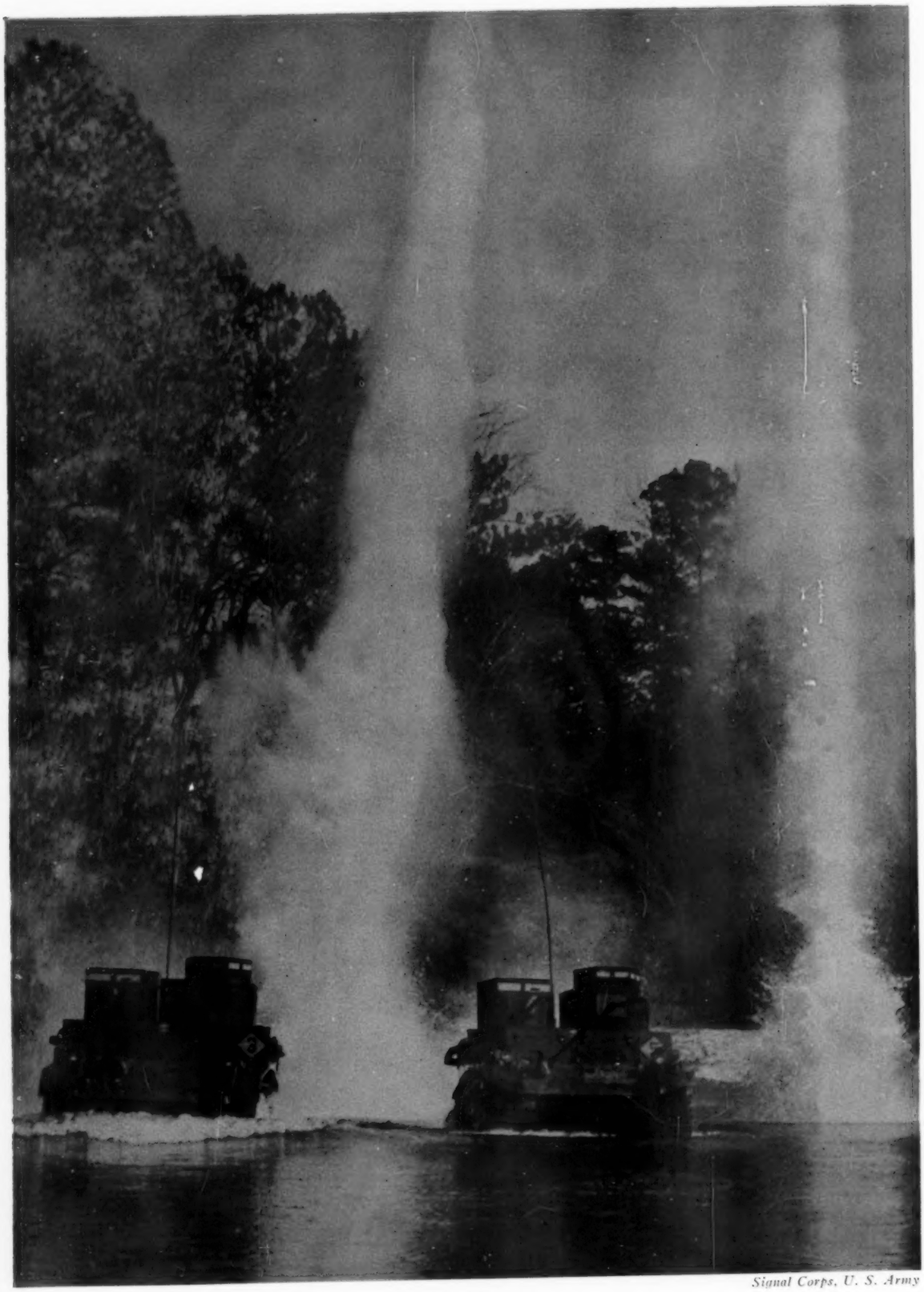


Signal Corps, U. S. Army

Land Battleships

ARMY ORDNANCE

Volume XXI MAY-JUNE, 1941 No. 126

Our Arms Grow Strong

A Progress Report on Ordnance Production Capacity

Maj. Gen. C. M. Wesson *

FOR my part, too long a time has passed since I last had the pleasure of being with the Ordnance contingent in Chicago. Frequently I have recalled with pleasure my last visit here on the evening of November 6, 1939, when I had the privilege to speak to you on "Military Armament Preparedness." Much water has gone over the dam since that visit. I pleaded then for a munitions-preparedness policy—one approved by the nation—one which had a definite objective. That we now have. To gain our objective and retain it requires the creation of numerous and costly production facilities because, as I have so often pointed out, ordnance is special and technical, is noncommercial, requires special facilities, and takes a long time to produce.

There are also sentiments of heartfelt thanks which I must express. First, and for me always first here in Chicago, is our toastmaster, Mr. Edmund A. Russell, president of the Chicago Post, Army Ordnance Association, who directed the ordnance mobilization effort in the Chicago area during the World War. He has been a tower of strength in the industrial-preparedness movement for the past twenty-five years. He is typical of that band of stalwarts who threw their weight and strength into our last great national ordnance effort and who still are carrying on in this emergency. May their progeny be plentiful.

Next, I wish to thank publicly the chief of the Chicago Ordnance District, Mr. Fred A. Preston. Mr. Preston succeeded Mr. Russell as district chief in this ordnance area some ten years ago and has continually given the very best of his effort toward our plans and our activation of industrial mobilization. The fact that industry in Chicago has been able to contribute so much toward the solution of our present ordnance problem is due in large measure to the fine leadership of Mr. Preston and his associates and advisors here in the Chicago Ordnance District. Allow me also to pay tribute to the work of Mr. Preston's assistants; notably, Mr. Phelps Kelly, assistant district chief, and Col. Donald Armstrong, his very capable executive officer. Permit me also at this time to pay tribute to the memory of the late C. Raymond Messinger who, until his untimely death in February, was also an assistant district chief. His loss is no less great to the ordnance cause than it is to industry here in the Middle West.

In so far as the Army Ordnance Association is concerned, I can say that my admiration for its work grows with each passing day. On numerous occasions, during the past three years, I expressed the belief that the work of this nation-wide society for Ordnance preparedness is one of the unique things in the history of American national defense. Here is a group of American citizens who have banded themselves together for only one purpose—the industrial preparedness of the United States. In the light of our World War experience the value of the work of this national society is beyond appraisement. In the light of our armament effort of today I can well and truthfully say, as Chief of Ordnance of the Army of the United States, that without this society our present efforts would not be nearly as successful as they are. To all of you my very heartiest thanks.

I PROPOSE to discuss our ordnance-production capacity because it would seem to be most timely. By the same token it is probably a subject with which the average person is least familiar. Yet it goes to the very root of our ability to defend ourselves on land, at sea, and in the air. For unless the American people get clearly into their heads now just what the meaning and implication of armament-production capacity are, not only may we fail in our present undertakings, but in the years to come we again may be guilty of the very mistakes which are now responsible for the long time factor of our military preparedness.

The difficulties we are experiencing in starting this tremendous program are perfectly understandable. The amazing thing to me is the short time that it has taken to place contracts for ordnance matériel amounting to approximately $2,000,000,000 and contracts for approximately $600,000,000 worth of new plants. However, I would feel remiss in my duties if I did not at this time sound a note of warning. We foresee difficulties ahead which may interfere seriously with our production program. Delays are beginning to crop up in a number of instances, due principally to the failure to obtain scheduled deliveries of machine tools and special equipment. Intelligent use of priorities is essential. At the time we are coming to grips with these real interferences we are hopeful that no artificial interferences will be added; and when I say artificial interferences I refer to delays arising out of selfishness, fear, or arrogance on the part of government or on the part of management or on the part of labor. Every one has to realize at once that there must be teamwork. Our national security is a serious business and only serious people have the slightest warrant for being connected with it at all.

Now let me get down to a matter of one or two simple definitions. What I have to say tonight has to do with armament-production capacity. By that I mean the ability to produce in the United States those *noncommercial* things which in the aggregate we call ordnance. They include the guns, the ammunition, the powder, the explosives, the tanks, the bombs, the fuzes, the rifles, and the related equipment for which we have no adequate peace-time industry. When I

*Chief of Ordnance, U. S. Army.
This is an address delivered before the Chicago Post, Army Ordnance Association, March 17, 1941, Palmer House, Chicago, Ill.

speak of production capacity, therefore, I mean the ability to produce the things with which a soldier must be equipped to wage successful war and without which he is easy prey to a vigorous antagonist.

Notice that I use the term "noncommercial." I am not now talking about railway equipment or bridges or trucks or food or clothing because all these things are commercial. American industry is busily engaged in developing them and their uses in normal times and is always anxious and willing to produce them in times of peace as well as in times of emergency. But despite the great variety of your great mail-order houses in Chicago you have never found field artillery listed in their catalogues. Under our economy you cannot send in a postal card and order a 500-pound bomb. Neither can you supply the tape-measure statistics and order a tank. These things are not commercial. And yet they are the very things which in time of national emergency are needed in tremendous quantities by the armed forces of the United States.

IT HAS been our policy always to rely upon the six manufacturing arsenals operated by the Ordnance Department of the Army for the small quantities of arms needed in time of peace. One of these great establishments is at Rock Island. I refer to the Rock Island Arsenal under the command of Brig. Gen. N. F. Ramsey. Many of you joined with us at the annual meeting of the Army Ordnance Association which was held at Rock Island three years ago. The prime function of our arsenals is to keep alive the technique of arms production in time of peace. Today, however, they are operating on a 3-shift basis and are employing 35,000 men and women and are turning out material and equipment in substantial quantities. Allow me to say with considerable pride, that the production methods developed by them have been of inestimable aid to private manufacturers who have entered into ordnance contracts. But in terms of capacity as against total requirements for a major emergency, it is estimated that the arsenals are capable of producing not more than ten per cent of our entire needs, so that we must look to private industry for the remaining ninety per cent.

But private industry itself is limited by its inability to produce all types of armament. Let me explain: It is perfectly understandable that industry can with only a slight delay transform part of its equipment for the production of certain items which may be classified as munitions. However, there are certain classes of armament for which there is little or no peace-time industry whatever and in which the transition from peace to war production cannot be accomplished.

Until these industrial voids are filled, no balanced production program is possible. If we do not have the capacity when needed, then there is no other alternative than to wait until that capacity is created. It is about these plants which have been brought into being or which are now in process of building, that I wish to speak. Just six months have elapsed since the program providing for this increased production capacity of noncommercial ordnance was authorized. In a way, what I have to say here is a progress report at the end of six months of effort.

The present expansion program has been predicated on the objective as laid down by the War Department; namely, to provide equipment for an army of 2,000,000 men and facilities to maintain such equipment. Please do not misunderstand me—the Congress has not authorized an army of this number. I restate: The objective as far as equipment is concerned is based on an army of 2,000,000 men. To meet this objective and be prepared to maintain it we have known all along that production capacity would be required for certain critical items and processes. This list includes smokeless powder, high explosives, ammunition loading, small-arms ammunition, rifles, machine guns, and tanks. Therefore, permit me to recite briefly for you what we have done toward obtaining this vital production capacity.

Facilities for the manufacture of smokeless powder are already under construction at Charlestown, Ind., and Radford, Va., at a total estimated construction and equipment cost of $145,000,000. Additional capacity is to be provided at a plant to be located at Childersburg, Ala. Production of small-arms powder in limited quantities started last Friday at the Radford plant, and production of cannon and small-arms powder will begin at the Charlestown plant in about two months. The balance of production will come in during the remainder of 1941 and the first half of 1942.

Facilities for the manufacture of large quantities of TNT, DNT, and tetryl are now under construction at Wilmington, Ill. (only a few miles from the great metropolis of Chicago), and Weldon Springs, Mo., at a total cost of $47,000,000. Initial production of TNT is expected to start in August 1941, and the balance of the above-mentioned capacity should be attained by November 1, 1941. Additional capacity for these items is to be provided at a plant located near Sandusky, Ohio.

WITH regard to loading plants, the only peace-time loading of military explosives is the small amount carried out at our Ordnance establishments. Six plants for bomb and shell loading, estimated to cost $80,000,000 are being constructed at Savanna, Ill.; Ravenna, Ohio; Wilmington, Ill.; Union Center, Ind.; Burlington, Iowa; and Milan, Tenn. One bomb-loading line at the Savanna plant was completed on October 21, 1940, and is now in use. The other plants are scheduled for completion during the present calendar year. Construction work has started on two small-arms ammunition plants located at Kansas City and St. Louis, Mo., which are estimated to cost a total of $38,000,000. The plants are expected to be in operation about January 1942. A management-and-equipment contract for a third plant at Denver, Colo., was approved on January 4th. The estimated cost of this plant is $21,000,000. These plants will produce the standard types of caliber .30 and caliber .50 ammunition used by the Army and Navy.

Much has been heard of the Garand semiautomatic rifle which Springfield Armory is producing. An extension to this plant, costing slightly over $3,000,000 will be completed by June and will double the present capacity. We also are obtaining considerable production of rifles from a commercial source.

With regard to machine guns, contracts have been entered into between the War Department and private industry whereby the Government is furnishing and installing equipment in five plants located at Utica and Syracuse, N.Y.; Flint and Saginaw, Mich.; and Dayton, Ohio, at an estimated cost of $38,000,000. Manufacture of gun barrels already has been started in the Flint plant, but the plants as a whole are not expected to be entirely equipped prior to December 31, 1941. These plants will go a long way in relieving the critical situation due to the extremely limited existing production capacity of machine guns.

A plant estimated to cost $20,000,000 for the manufacture

of medium tanks is being constructed at Detroit, Mich., and is scheduled for completion in September of this year, but the first tank probably will be produced during July.

Of course, there are many other items. In addition to these finished articles we have to create a considerable capacity for the production of raw materials, such as the plant for the production of toluol from petroleum at Baytown, Tex., and the facilities for the manufacture of ammonia at Morgantown, W. Va., and Henderson, Ky. We once had considerable productive capacity in these same fields. If, following the World War, we as a people had held on to our productive capacity of noncommercial items instead of scrapping the plants, our present task would be much lighter.

WITHOUT serious delays and with teamwork on all sides, our program of new plants to meet the War Department objective will become a reality early next year. Let us assume then, that we have our program in operation and that it continues in operation until the current need is met. What then are we to do with our production capacity for non-military items of equipment? My plea, even at this stage of things, is to see to it that our production capacity—once we get it—is kept available in stand-by condition. I do not favor government plants except for that which is absolutely necessary. I hope that the day never comes when the factories we are now building for the production of armament will be operated by any one other than the private industry of the United States. That is the American way. But our greatest danger will be in the ruthless scrapping of these facilities once the present emergency shall have passed.

I ask you to give serious thought to the retention of these facilities in stand-by condition to meet our armament needs for years to come. As their machinery becomes obsolete it should be replaced with new machinery. And in the process of so doing we should consider such expenditures of public funds as being entirely on a par with the replacement of obsolete equipment in any other field of national defense, whether it be destroyers, battleships, airplanes, or guns. In this day and generation, the factory and its machinery are of the same status as the fighting equipment of the soldier on the battlefield.

In conclusion, let me narrate an ordnance incident of eighty years ago. I was reading the other night the notes of Brig. Gen. Josiah Gorgas, Chief of Ordnance of the Confederate States of America. General Gorgas was a great soldier. I doubt that there is a more valuable ordnance paper in existence than his notes; they teach many a lesson of current significance; they recount the great efforts which were made for improvising ordnance in the Confederacy. I quote one paragraph on the conditions of the arsenals, workshops, and foundries in the South when General Gorgas took command:

"Within the limits of the Confederate States, there were no arsenals at which any of the material of war was constructed. No arsenal, except at Fayetteville, N. C., had a single machine above a foot lathe. Such arsenals as these were, had been used only as depots. All the work of preparation of material had been carried on in the North; not an arm, not a gun, not a gun carriage, and, except during the Mexican War, scarcely a round of ammunition had for fifty years been prepared in the Confederate States. There were consequently no workmen, or very few of them, skilled in these arts. No powder, save perhaps for blasting, had been made in the South; and there was no saltpeter in store at any point; it was stored wholly in the North."

How history repeats itself! While no one would contend that the recent plight of the Army of the United States was nearly as desperate regarding production capacity for ordnance as was that described by General Gorgas, nevertheless our needs for production capacity of noncommercial ordnance were not unlike the Confederate need. It is only now that we are beginning to meet that need. We *are* meeting it! Many of the new facilities for production capacity are being erected in the Middle West. Here strategic necessity indicates that we should place much of our strength. Here, also, facilities and labor are generally available in sufficient quantity and quality.

AT LONG last, we are beginning to realize our military strength. At long last, industry, management, labor, and the people as a whole are becoming cognizant of the tremendous implications of the armament program upon which we have embarked. We are spending $3,500,000,000 for ships, $1,500,000,000 for factory expansion and housing, $1,500,000,000 for airplanes, $600,000,000 for ammunition, $500,000,000 for guns, $400,000,000 for trucks and tanks—and soon these quantities will no doubt be increased greatly. This is a tremendous task. It calls for the ingenuity, the coöperation, the understanding of every man, woman, and child in the United States. It calls for no bickering or petty animosities. It calls for hard work and sacrifice, commensurate with that of our young men who are being called from their civil pursuits to serve with the colors. It calls for production and yet more production!

But underlying all these things I place greatest emphasis upon our production capacity for noncommercial armament. Once we get that capacity let us hope the people will have the good sense to keep it. Based on what I have said I think you can agree with me that "our arms grow strong." I appeal to you to help that growth now in every way that you can. And I plead with you that once we have grown strong in this regard let us remain so. Every day, weak nations fall by the wayside. In our moral and material strength lies our greatest guarantee of freedom and peace. Our ability to produce armament in peace and in war is closely connected with both our moral and our material power. Let us all see to it in a world of broken pledges that we remain firm in our allegiance to our arms. For as our arms grow strong, so also grows the security of our freedom and our peace.

Civilian Ordnance Training

A Program of Practical Training to Produce Capable Workmen

Brig. Gen. C. T. Harris, Jr.*

WHEN the crossed cannon and flaming bomb escutcheon of the Ordnance Department is stamped upon completed Ordnance matériel, more than perfunctory inspection procedure has been performed. The Ordnance Department has approved final acceptance and awarded its hallmark. To the using arms and services it is a symbol that, on the fields of maneuver or combat, full trust may be placed in the efficiency and dependability of this matériel. The origin of the superior standards expressed by the escutcheon can be traced to the day each civilian Ordnance technician, whether apprentice or college-schooled engineer, raises his right hand and takes the oath of allegiance to the United States.

The definite guarantees embodied in the Ordnance insignia demand that every one of the Ordnance technical personnel, whatever his grade may be, have a thorough knowledge of his job. Each must have a sober realization of the fact that one day the lives of other men may depend upon how well he has executed his work. Long ago, the Ordnance Department was aware that trained troops in the field must be supported by trained technicians in the shops. And, long ago, the Ordnance Department began planning for the time when an emergency period would create unprecedented expansion of its activities. It was recognized that among the major problems would be an almost absolute lack of the trained civilian personnel necessary to augment the skilled arsenal forces which in times of peace keep alive the arts of armament making. Accordingly, training programs were formulated, analyzed and revised. The program objective was, and is, practical training to produce capable workmen.

The all-important time element of training in periods of emergency is a variable but is held to the minimum consistent with effective results. Preparation of the training courses has used the Ordnance experience gained during the World War as well as the latest applicable commercial methods, together with those of our arsenals and laboratories.

ESSENTIALLY, the broad problem of the Ordnance Department's civilian technical personnel is twofold: First, the procurement of suitable personnel and, secondly, the training of this personnel. These operations are, according to plan, being carried on without interruption of Ordnance procurement and without interference with other major phases of our program. They are, in fact, benefiting the defense effort by contributing a steady and increasing flow of capable personnel. This personnel is divided into four principal classifications: operating (production), inspection, administrative, and service and testing.

From known future armament requirements we were able to compute our civilian personnel requirements. Each increase in armament requirements brings a proportionate increase in the need for personnel in these categories, as well as for other Ordnance personnel.

To conduct the training program and extract the utmost efficiency with the least amount of top-heaviness, the following echelons were established:

1. Training Section in the Civilian Personnel Division, Office of the Chief of Ordnance.—The duties of this section are the coördination and supervision of all civilian training. This section is responsible directly to the Chief of Ordnance. Personnel consists of one officer, a training consultant and two stenographers.

2. Division Training Sections in each division of the Office of the Chief of Ordnance.—Their personnel consists of one officer representing the division chief for liaison with the training section of Civilian Personnel Division.

3. Arsenal and Ordnance Establishment Training Sections.—The commanding officers, generally speaking, are responsible for the training of their own personnel and such personnel as is sent from other establishments for training subordinates as training directors. They have charge of administration of training programs at each station. Working under them are division or section chiefs who act as instructors or assign skilled officers or civilians as instructors.

The Ordnance Department has borrowed from the Department of Commerce a training-program expert who spends most of his time in the field assisting in the preparation of training programs or aiding Ordnance officers in arranging for use of educational-institution or industrial shops and laboratories for training Ordnance personnel.

Working in close collaboration, these groups administer the program by analyzing the future training needs in terms of the number and types of employees to be trained, determining the amount of training needed, determining when these trainees will be needed for productive work and adjusting the courses to meet the time deadline, and providing facilities for training purposes, such as shops, laboratories and machines.

The training program has been well under way for some months, and it is imperative that this should be so for great strides also have been made in production.

Because many of the civilian Ordnance technical job classifications have no exact counterpart in industry, the greater part of such training must be conducted within or by the Ordnance Department. Training courses for technical personnel brought into the Ordnance Department for the emergency period have been operating since 1939 at the six manufacturing arsenals and at Ogden and Savanna Ordnance Depots. Others have come into being in a number of specialized industries. Training of employees has, of course, been conducted at the arsenals in connection with normal, nonemergency operation.

ALL new Ordnance employees are given specific instruction in their duties, beginning when they enter Ordnance employment. This instruction may be a matter of weeks—or years. The latter period applies to Ordnance engineers, whose training lasts five years. They, like the others whose jobs call for lengthy instruction, are engaged in productive work throughout the training period.

*Assistant to the Chief of Ordnance. Chief, Industrial Service, Ordnance Department. Brigadier General, Ordnance Department, U. S. Army.

A limited number of key personnel employed by Ordnance contractors are trained by the Ordnance Department. The Department also coöperates with educational agencies in planning courses which will fit students for Ordnance positions and likewise plans evening-school courses for Ordnance employees. After working hours, supplemental training courses are being conducted in arsenals and at neighboring trade schools, the latter on a coöperative plan whereby part of the machinery and some of the instructors are furnished by the Ordnance Department. More than 2,500 arsenal employees are receiving this instruction, including foremen, assistant foremen, inspectors, set-up men, toolmakers, machinists, tool designers, gage checkers, grinders, machine operators, and blue-print operators.

"Recruiting" of our civilian technical personnel is carried on principally by the United States Civil Service Commission, and all Ordnance civilian positions come within Civil Service authority. The Commission's district offices have been of material aid in furnishing this personnel.

WHETHER temporary or probational (permanent), each new employee is checked by Civil Service investigators: every statement on his personal history questionnaire is verified with care; his character references are interviewed and every effort is made to determine if he is a citizen of undoubted loyalty. Each new employee is fingerprinted and the fingerprint cards are forwarded to the Federal Bureau of Investigation in Washington, where they are first checked against the "wanted" files and then recorded.

Surveillance, however, does not cease once the employee's character and background have been given clearances. This does not mean that employees are spied on, for they are not. This surveillance perhaps might be better expressed by the word "guidance," for the supervising personnel have an active realization of the fact that newcomers are going to need help, training, and advice, based on experience.

The Ordnance Department must at all times sustain in its arsenals, shops, depots, establishments, and stations, a spirit of loyalty equal to that of our combat troops. Our armies can be no better than their weapons and the weapons no better than the workmen. The wielding of the weapons is the job of combat troops, but the welding is that of the Ordnance Department. To wield the weapons, troops must be trained, and to weld the weapons, Ordnance workers must be trained. Our program is dedicated to this premise.

The excellence of Ordnance training has, in itself, added a minor problem which is complimentary to the Ordnance Department and at the same time vexing. A number of Ordnance-trained men, inspectors in particular, have gone from our schools to duty in contracting plants and have so impressed certain contractors that they have hired them away by salary inducements. In one sense, this is beneficial to the Ordnance Departmeat for it places in industry men who know Ordnance standards and procedures and, in the long run, should be of mutual value to industry and the Government. However, steps are being taken to restrict this hiring away to a minimum.

From our arsenals there are reports of new Ordnance inspectors—college-trained engineers—reporting with overalls under their arms—new overalls nobody told them to buy—not that they won't use them.

It is a good sign when young men carry overalls to a new job. It indicates that they want to work—and as long as young Americans are eager to work, either as soldiers of the shops or as field troops, the United States is unbeatable.

Many reports are received from our districts describing how Ordnance inspectors push through blizzards, storms, and mud to make inspections on schedule so that production will not be delayed or delivery dates missed. One of our district civilian inspectors, suffering from influenza, drove upward of 150 miles to make inspections at plants in 3 different cities. Near collapse after the third inspection, he was ordered to bed in a plant infirmary by a company physician. But they could keep him in bed only a couple of hours; he got up, drove another hundred miles, and made another inspection.

To get a complete picture of the organizational structure of the training program which is turning out men of this type, consider here the first of its four principal elements, already stated, namely the operating personnel (production).

All six manufacturing arsenals—Springfield, Picatinny, Watertown, Watervliet, Frankford, and Rock Island—are now conducting training programs for skilled and semi-skilled workmen, professional and subprofessional personnel. Savanna and Ogden Ordnance Depots, have more than doubled their personnel for training workers to operate new loading plants under construction, and they have training programs functioning to meet the expansion. As other renovation plants are expanded, similar training programs will be put into effect.

Length of the training term is varied to meet the qualifications of employees at the time they report, the rapidity with which they learn the required skill, and the degree of skill required for the specific job they will do. For example, Ordnance engineers are kept in training for five years; apprentices are given a full 4-year course before being promoted to journeymen; skilled laborers are trained for jobs as explosives operators in as short a time as thirty days, although six months or more are usually required; shop boys are prepared for assignments as single-purpose machine operators in about six months; machinists brought into Frankford Arsenal are assigned as understudies to experienced, competent instrument makers and are kept in training on work of a general nature at least thirty days before being given specific assignment.

ORGANIZED and planned training programs are provided for virtually all types of production personnel where any degree of skill is required. Apprentice machinists are being trained in the six manuacturing arsenals. Experienced machinists are being given advanced training at Springfield Armory, Frankford, Rock Island, and Watervliet. Explosives operators are in training at Picatinny Arsenal, and at Savanna and Ogden Ordnance Depots; mechanical-fuze assemblers at Frankford Arsenal; single-purpose machine operators at Springfield Armory, Watervliet, and Frankford, and tool and gage designers at Watervliet, Springfield, and Watertown. Of these several classifications, there are now in training 200 men at Watertown Arsenal, 1,100 at Springfield Armory, 500 at Watervliet Arsenal, 1,600 at Frankford Arsenal, 800 at Rock Island Arsenal, 200 at Savanna Ordnance Depot, and 300 at Ogden Ordnance Depot.

Future training needs will depend upon several variables which are now undetermined. The considerations will include additional work assigned to production establishments in the Ordnance Department, the caliber of personnel recruited by the Civil Service Commission as needs for additional personnel arise, future programs for Ordnance-oper-

ated plants, and the construction of agent-operated plants.

As regards inspection personnel, this phase of the training program is being conducted at the six manufacturing arsenals, at Aberdeen Proving Ground, and at certain industrial plants and educational institutions. It will be expanded in loading plants and depots when these new establishments are opened. Courses for inspectors last six weeks for artillery and small-arms inspectors; eight weeks for inspectors of ammunition components, powder explosives inspectors and chemists, and approximately six months for ammunition inspectors.

Inspectors' courses are as follows: At Frankford Arsenal there are courses for the inspection of artillery ammunition, mechanical time fuzes, instruments and optics and small-arms ammunition; at Picatinny Arsenal, courses for inspection of metal components, loading and assembling, powder and explosives, and chemistry; at Rock Island Arsenal, courses for inspection of mobile artillery carriages, automotive matériel, recoil mechanisms, machine-gun mounts, machine guns and equipment; at Watertown Arsenal, courses in general inspection and welding; at Watervliet Arsenal, courses in cannon inspection and gage checking; at Springfield Armory, courses for inspection of the M1 rifle, automatic pistols, and machine guns, and at E. I. du Pont de Nemours & Company, courses for inspectors and chemical engineers.

Nearly 1,100 inspectors have been trained since last July, and more than 300 are now in training. It is estimated that approximately 4,000 more matériel, powder, and explosives inspectors will be needed, depending upon national-defense contract increases.

Two- to five-month courses are conducted at the six manufacturing arsenals and Savanna Ordnance Depot for administrative personnel. Instruction covers arsenal administrative procedure, fiscal operations, procurement procedure, property control, personnel procedure, planning, and mail and record. Sixty-five men have been trained thus far. Carefully selected, they probably will act as instructors in future training if planned organized training is necessary in this field.

TRAINING is being conducted for service-and-testing personnel at Rock Island, Frankford, Augusta, San Antonio, and Benicia Arsenals, and at Aberdeen Proving Ground. Courses run from thirty days for single-purpose instrument repairmen to eight months for all-around instrument repairmen. Training includes courses for armament machinists, small-arms assemblers, instrument repairmen, proving-ground engineers and mechanics, munitions handlers, and other storage personnel. About 400 of this type personnel are now in training. Future training needs in this group also depend upon the rate at which matériel is furnished troops, the usage it receives, the quantity of maintenance and repair handled directly by military personnel in the field, and upon construction of additional proving grounds and depots.

The six manufacturing arsenals are largely engaged on job work. Employees with diversified skills are required, and a relatively low proportion of single-purpose operators can be used. For this reason, the Civil Service Commission recruits both experienced and inexperienced personnel for the arsenals. Training procedure is designed to fit new employees for jobs requiring either specialized or diversified skill, depending upon the employee's previous schooling and experience at the time he is appointed. Arsenal training is designed to meet the needs of personnel employed only for the duration of the emergency. However, there has been no lowering of standards for the training of arsenal employees.

Employment difficulties are anticipated at the agent-operated plants (mostly those engaged in the manufacture of powder and explosives or in bag, shell, or bomb loading) since they are located in areas where there are no reservoirs of skilled workmen experienced in this or related fields. Trade schools educating employees for the metal trades can be of little assistance to the explosives industry. These plants will present special problems in the recruiting and training of personnel. The Ordnance Department can assist only with the training of a limited number of key operating personnel which will administer training on the job.

ORDNANCE contracts with industry are supervised by thirteen Ordnance district offices. Operating personnel in these industries is employed entirely by the contractors and the Department is not responsible for their training. Ordnance acceptance inspectors, previously mentioned, are being trained in the arsenals at a rate of about three hundred every two months. Trainees in the arsenals work under direction of arsenal foremen and inspectors. They perform the duties of inspection and also learn the job of each workman producing matériel which they will later inspect in factories.

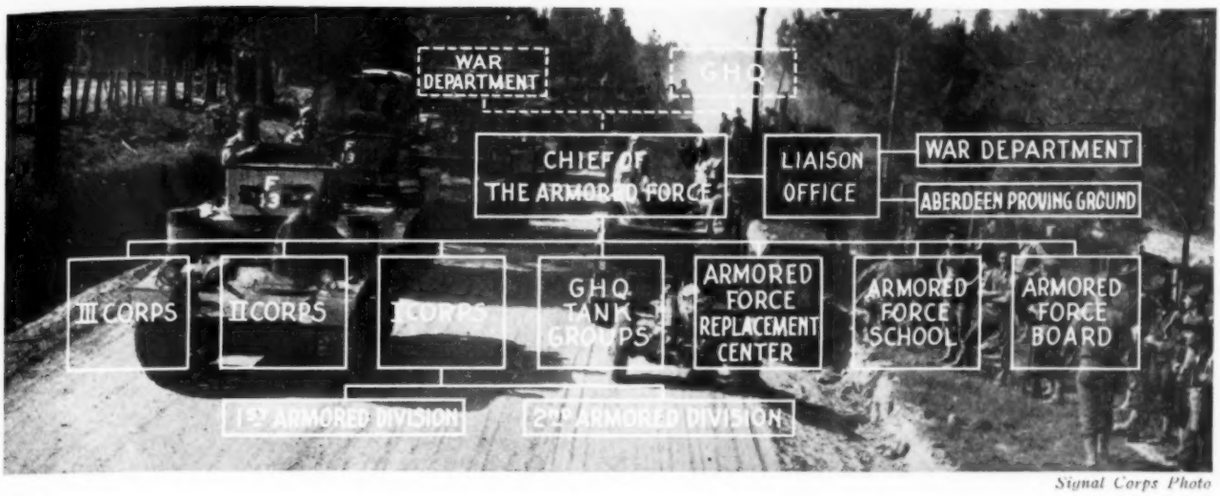
As accepted matériel moves in quantity from industry to depots, the Ordnance Department must increase its facilities and personnel for storage, transfer, maintenance, repair, and testing of armament. Types of skill required are varied and there is no industrial source from which fully qualified employees can be obtained.

For some of the jobs under Field Service and the Technical Staff it is necessary to select outstanding machinists in manufacturing arsenals and give them full-time training for six to eight months in different Ordnance establishments and in industrial concerns. In other cases, it is possible to recruit trade-school boys and use them on single-purpose jobs after a few weeks of training. Here, as elsewhere, training procedure is adapted to meet the needs.

Immediate future needs in skilled personnel in more than 70 Army establishments total almost 3,000 men. These include ammunition inspectors, armorers, assemblers, barrel drillers, barrel chamberers, barrel reamers, barrel riflers, barrel threaders, chemists, explosives inspectors, tool and gage designers, die makers, die setters, die sinkers, mechanical draftsmen, chemical engineers, mechanical engineers, shop foremen, ordnance matériel inspectors, instrument makers, instrument repairmen, lens grinders, machinists, metallurgists, star-gage operators, and tool makers.

Part of this problem will be solved by drawing upon trained men now at work in our establishments. Part will be solved by recruiting trained or partially trained men whose civilian experience is compatible with ordnance work. But the greater part may be solved by training alone.

As regards the civilian training program, then, it is clear that plans prepared well in advance have enabled the Ordnance Department to procure and train personnel in sufficient quantities to further Ordnance production—its principal objective. Moreover, the flexibility of these plans facilitates their steady development to cope effectively with future technical personnel training requirements. The combination of effective advance planning and an already functioning program, therefore, simplifies overcoming future hurdles and solving the normal lesser problems which may be encountered. The Ordnance planning and training program in action has tolerated no compromise of Ordnance standards. The Ordnance escutcheon is a time-honored hallmark.



Signal Corps Photo

The Armored Force

Newest Fast-Moving Power of Our Army

Maj. Gen. C. L. Scott*

WE ARE living in a machine age—an oft-repeated fact but one of the greatest military significance. As a result, one sees all the major powers of the world in this period of emergency desperately striving to utilize all types of equipment to produce the additional machinery and armaments needed in modern warfare. Among the new means required for battle may be mentioned airplanes of many types; motor vehicles; light, medium, and heavy tanks; antiaircraft and antitank weapons.

The introduction of this machinery and new units into an army requires careful study, intensive training, and new methods of operation to secure the necessary teamwork between the new elements of our Army and the old arms which have withstood the test of past battles. Aviation, armored units, motorized units, and other normal units are all playing an important part in battles of today. The greatest success is being attained only when each arm is utilized to fill its prescribed rôle as a member of the national combat team.

On July 10, 1940, the War Department issued a directive creating the most powerful, hard-hitting, mechanized ground member of the Army team—the Armored Force. Maj. Gen. Adna R. Chaffee was placed in command of it. By this step, all efforts were pointed to cohesive action for the new force under a single commander. In fact, I believe the creation of the GHQ Air Force and the Armored Force are the two most constructive and up-to-date steps taken by the War Department since the World War. These two GHQ units, furthermore, will work intimately and constantly in many operations to form a most powerful air-ground striking team. The chart (above) shows the organization of the Armored Force which is now well under way.

Before going into a more detailed description of the Armored Force, a brief outline of the history of mechanization is pertinent. As we know, the tank first appeared in the World War. It was designed to restore mobility to the battlefield by overcoming the light machine gun which had forced armies into trench warfare. The tank of that day was a slow, cumbersome, imperfect vehicle and it did not become a deciding factor in the war. However, many wide-awake officers of all nations realized the value and the great possibilities of future development and employment of armored vehicles in battle.

Two lines of thought developed with respect to the tank. Some believed that tanks should be used in close support of infantry with limited objectives and in relatively small numbers, in accordance with World War doctrines. In this case, the heavily armed and armored vehicle was required, and great speed and radius of action were not necessary. On the other hand there were proponents of mechanization who wished to employ large masses of armored vehicles against vital objectives deep in enemy territory to attain the total war conceived by Clausewitz. Although Great Britain, France, and Italy began in 1920 to experiment more and more with tanks and other armored vehicles, they failed to concentrate them in a single unit. Germany was forbidden the use of armored vehicles by the Treaty of Versailles. She stood on the sidelines and watched the developments of other nations until Hitler came into power. Then, when the Versailles Treaty became a scrap of paper, Germany definitely created a hard-striking, far-reaching armored force superior, in my opinion, in organization and equipment to any that existed in Europe. This superiority was due to the fact that procurement, supply, and command were concentrated under one head, and this head developed definite, straightforward doctrines for the employment of this force in mass.

IN THE meantime, our Army was not asleep. A few forward-thinking officers realized that we should not fail to take advantage of our preëminent position in the motor industry and of our vast national resources. However, there is no more common mistake than assuming that *potential* military resources constitute military strength—it is a fallacy to

*Commanding general, First Armored Corps, Fort Knox, Ky. Major General, U. S. Army.

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MOTORCYCLE TROOPS OF THE SECOND ARMORED DIVISION

which the American people have clung with the utmost persistency. The potential military *resources* of a state include all male citizens capable of bearing arms and all material which may be employed ultimately for military purposes. The military *strength* of a state is only that which it can bring to bear at the critical point on the field of battle. A male citizen is a potential military resource, but only trained soldiers can make an army. Iron ore in our mines is an important resource, but a cannon in action on the field of battle constitutes military strength—and it is a far cry from the one to the other.

In 1928, the Secretary of War approved in principle the development of a mechanized force over a period of four years at a cost of $4,000,000. However, it was not until 1930 that Congress gave the Army $280,000 to start this project. The depression then hit us, and Congress and the public were bent upon, and convinced of, the practicality of disarmament. The infantry tank units and the mechanized cavalry units struggled along as best they could until the value of armored units was proved definitely last spring.

On July 10th, our Army had about four hundred serviceable tanks, some of which were obsolescent, and five or six hundred other armored vehicles organized into three infantry tank battalions, several independent companies, and one small cavalry brigade. In spite of this pitifully small amount of mechanization, it had served a most useful purpose in the development of equipment, organization, tactics, technique, and sound tactical doctrines. Although we had worked independently and had in no way copied the Germans in their set-up or organization, our line of thought for development and employment in battle was strikingly similar in many ways to that of the Germans. Therefore, to our leaders in mechanization the results achieved by the German *Panzer* divisions were no surprise. In fact, these successes merely proved to us that we had for years a proper conception of the organization, equipment, and employment of armored forces as well as considerable sound experience in the use of small units.

IN THE press there has been considerable confusion as to the difference between the motorized unit and the mechanized or armored unit—and there is a vast difference. The motorized unit is one which transports a part or maybe all of its supplies, its weapons and personnel, to the battlefield in trucks. There the unit dismounts and goes into action, and most of its vehicles are sent to the rear. In very few instances are they employed as weapons on the battlefield. On the other hand, an armored unit transports all its personnel in armed and armored vehicles, most of which, such as tanks, are employed as weapons. This type of unit can fight mounted or dismounted, at a halt or in motion—usually by a combination of all these methods.

The Armored Force is particularly designed to execute all the highly mobile missions of the ground army—rapid strategical moves, deep envelopments, pursuit, exploitation of the break-through, etc. It works intimately and constantly with observation and combat aviation. The ratio of machine-gun fire power in armored units to that of other arms is very great. For example, the infantry streamlined division of 8,000 or 9,000 men carries and operates about 250 caliber .30 machine guns; the armored division of 11,000 men carries 4,000 caliber .30 machine guns—about 16 times as many as the infantry division!

Lieut. Col. J. K. Christmas, Ord. Dept., in a recent article on "Tanks" in the January-February 1941 issue of ARMY ORDNANCE (Vol. XXI, No. 124, p. 363), has ably pointed out that "the special economic value of the tank lies in its relative cheapness. The tank gives more fire power, more mobility, and more protection to our fighting men per defense dollar than any muscle-propelled hand-labor military organiza-

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SCOUT CARS AND TROOP TRANSPORTS OF THE ARMORED FORCE

tion. A tank moves over seven times as far per dollar as a cavalry unit and can hurl from five to ten times as many pounds of bullets at the enemy per man employed on our side. That is efficiency!"

The foregoing does not mean that the armored division is more useful and more powerful in all instances than the infantry division, because it is not. The armored division is sensitive to terrain and cannot work in mountainous country and marshes or when the terrain is cut up by numerous streams. It is an extremely powerful striking force with great fire power, but it is weak in man power for holding missions. It must be employed skillfully and forcefully at the appropriate time and place and must be followed up promptly by other arms in order to attain the greatest success in extensive operations.

THE tactical employment of an up-to-date armored unit and particularly the difference between present methods and World War methods are interesting. Today we are using tanks that can travel fifty miles an hour; in the World War we had slow, cumbersome vehicles capable of only two to three miles an hour. In the World War we employed these armored vehicles piecemeal in small units and directed them at the most difficult defenses which were holding up our infantry. This procedure is now entirely obsolete. For example, we now use the reconnaissance and infantry elements, and frequently supporting troops, to seek out the enemy line, to find a soft or weak spot in his dispositions. On this soft spot we concentrate support fire—machine guns, artillery, bombardment aviation—and when this spot is further softened up we then drive through with masses of tanks, not at limited objectives but deep into rear installations and nerve centers to paralyze the very heart of enemy resistance. The tanks are then followed up by all available troops to give the knockout blow to an already staggering enemy. We may liken the armored unit to a spearhead directed at a soft and vital spot in the enemy's armor. When thrown forward into this vital spot, the sustained power behind the spearhead is the might of normal troops of all arms.

It is well to know, too, that an armored force does not consist entirely of tanks. There are tank battalions, of course, but many other types of vehicles are included in the make-up of an armored division such as motorcycles, armored scout cars, half-tracks, and trucks. The division consists of elements of all arms and services mounted in armored vehicles peculiar to their missions.

An armored force is the most complex and highly integrated of the organizations found in a modern army. Its demands for trained technicians are heavy and cover almost the entire field of occupational specialists. We are utilizing some civilian schools and facilities to assist us in this training. We also have established an Armored Force School with a capacity of 6,000 students, and there we train the specialists required to operate, maintain, and repair the instruments and vehicles with which this force is equipped. Enlisted personnel are trained to be skilled workmen in a particular field, such as motor mechanics or radio operators. They are therefore given repeated practice in the operations they are to perform. Officers are trained as inspectors and supervisors of these operations, and while they are required to perform in detail such operations, emphasis is given in their instruction to the theory of the operation and the technique of inspection and check of the operations performed by the mechanic. The Armored Force Replacement Center is set up for 9,000 men who have to be trained as basic Armored Force soldiers.

IN THE development of our present tanks, the Chiefs of Cavalry and Infantry (who had this duty prior to the creation of the Armored Force) and the Ordnance Department very wisely insisted on securing a tank which had great speed,

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MOTORIZED ARTILLERY OF THE ARMORED FORCE

power, cruising radius and crew space for not less than four men. The value of speed, power, and cruising radius has been demonstrated fully in recent campaigns in Europe where fast tanks have outmaneuvered slow ones and where distances up to 1,100 miles have been covered in 5 days by armored units. As to crew space—the more men a tank can carry, the more weapons it can operate in a number of directions, and the more losses it can suffer without becoming ineffective. A 4-man tank therefore is not just twice as effective in combat as a 2-man tank but many times more so.

In substance, it is believed that the Ordnance Department has produced for us one of the finest multiple-place tank chassis in the world, but we still are faced with the problem of improving the inside of the tank and its armament in order to make it the finest of fighting vehicles. Fortunately, many of the necessary changes can be made, and are under way, without slowing production—which is of particular interest now.

Among tank developments of paramount importance are: improvement in cold-weather starting, power traverse for turrets, periscopic sight, indirect-vision devices, electric control of guns, and adequate padding for the crew. All these have been under consideration for years and progress is under way for most of them. Also while it is now necessary to freeze designs in order to attain maximum speed of production, we must look to the future and produce new models if we are to be assured of maintaining a superiority in equipment over any likely enemy. The requirement of new models for tanks will closely parallel those of the Air Corps in that the demand will be for more speed, more power, larger crews, more armor, and better armament.

With the continuation of the close spirit of coöperation that exists between the Armored Force, the Ordnance Department, and our automotive industries, all present and future problems of production unquestionably can be solved. The importance of producing up-to-date equipment, of maintaining a superiority over any likely enemy in this respect, and of the peace-time training of units cannot be overstressed. Frederick the Great said: "In my opinion, we owe the happy results of our battles and campaigns much rather to our work in time of peace than to the brilliant inspirations of some genius."

EDITOR'S NOTE.—As this article goes to press, the War Department has ordered the activation of the 3rd and 4th Divisions of the Armored Force, thus doubling the strength of the present organization. It is proposed to add four more divisions in the fall, thus doubling the Force again, and five separate heavier battalions are expected to be added during the summer. It thus appears that our armored forces, which numbered only 5,000 men a year ago and which now have nearly 40,000 men, will number 80,000 by January.

The additional officers, commissioned and noncommissioned, and the technicians needed for this expansion have been in training for months with the 1st Armored Division at Fort Knox, Ky., and with the 2nd Division at Fort Benning, Ga. Half of this number, totaling 7,500, will now be sent to Pine Camp in northern New York for the formation of the 4th Division, while half will be sent to Camp Polk in Louisiana where the 3rd Division will start training. To these cadres, about 8,500 selectees will be added, making in each case a division of 12,000 men, employing nearly 400 light and medium tanks, nearly 300 heavily armed and armored scout cars, and about 2,000 other vehicles.

The separate armored battalions will constitute a GHQ force, distinct in equipment and purpose from the armored divisions. Composed of medium and heavy tanks, this GHQ force can be used to effect the initial break-through of an enemy line which can be exploited by the faster and more fully equipped armored divisions.

Ordnance Metallurgy

The Functions and Personnel of the Ferrous Advisory Board

Brig. Gen. R. W. Case*

THE Ordnance Department Metallurgical Advisory Board as originally established in 1923 was created primarily to aid and advise the Department in the preparation and revision of metal specifications. This action was in recognition of the need for closer coördination of the problems and activities of the Department with those of commercial industry. One of the lessons taught by the World War and emphasized in the present conflict is that, in a major effort, a nation to survive must utilize effectively all its resources—economic, industrial and technical.

The Metallurgical Advisory Board has developed into an essential coördinating body in the broad field of metals to keep industry in touch with Ordnance requirements and to keep the Department informed as to industrial developments in materials, tools, processes, and production methods. The board also may be regarded as one of the devices through which technical mobilization is achieved. It is an expression of the basic policy of coöperation between the Department and industry in the solution of ordnance problems.

The original board included members specially selected from industry because of their familiarity with quantity-production methods and because of their general metallurgical knowledge, both in the ferrous and nonferrous fields. While its personnel has changed and its work has been broadened, the same fundamental ideas continue to motivate its actions. Its activities have been materially responsible for the remarkable spirit of coöperation characterizing the relations between the Department and industry. It also provides a typical example of splendid patriotic service, for most of the work performed by representatives of industry on the board has been with little or no financial remuneration.

Until a few years ago, the board normally consisted of approximately ten members, including service representatives. It always has functioned under the immediate supervision of the commanding officer of Watertown Arsenal, Watertown, Mass., in accordance with policies approved by the Chief of Ordnance. This, it is believed, was a natural arrangement in view of the fact that the laboratory at Watertown Arsenal has always been, and still is, the center for general and ferrous metallurgical research for the Ordnance Department. Much of the work of the board has been done at Watertown where its official records are maintained.

FOR many years, largely through considerations of economy, the board conducted much of its business by mail. Proposed ordnance specifications and suggested changes to existing specifications were forwarded by the director of the laboratory at Watertown Arsenal, who customarily was the board's secretary, to members for review and criticism. In some cases, extended discussions of specification matters were carried out by correspondence. Generally the board met once a year, either at Washington, D. C., or at Watertown, to consider in conference important questions bearing on specifications and to review progress of the past year. Metallurgical matters, proposed by members of the board, pertaining to production problems and research-and-development activities also were considered.

During recent years, the expanding activities of such specification-making bodies as the Society of Automotive Engineers, the American Society for Testing Materials, the American Iron and Steel Institute, the American Standards Association, the American Founders Association, and the Federal Specifications Board, have greatly facilitated the work of the Advisory Board. In particular, a notable example of industrial coöperation was the appointment about six months ago of a special committee on Government specifications by the American Iron and Steel Institute to assist Government departments and agencies in formulating and interpreting specifications for steel products. This committee, with which the Metallurgical Advisory Board maintains direct contact, has obviated the necessity for the formation of a special group within the board and is rendering splendid service in connection with the preparation and review of ordnance specifications.

The early contributions of the board in the preparation of metal specifications have been of material assistance to the Ordnance Department in its manufacturing and procurement activities. The present system of War Department metal specifications, together with the vast number of specifications prepared thereunder, stands as a worthy monument to its efforts.

Recently, with the advent of the present emergency, the volume and scope of metallurgical research and development work have greatly increased. Many problems vital to production, which come under the cognizance of the Advisory Board, are continually being presented by the munitions program. Its attention is being directed not only to important matters bearing on specifications but also, in increasing extent, to considerations of the broader aspects of research and development of ordnance matériel.

IN JULY 1940, circumstances clearly indicated that the work before the Advisory Board had become so great that a division of the board into two parts (ferrous and nonferrous) was necessary. The Nonferrous Metallurgical Advisory Board was therefore established by the Chief of Ordnance to be coördinated through Frankford Arsenal to handle nonferrous matters. The old Metallurgical Advisory Board accordingly was reconstituted and recently expanded to meet increasing activities and responsibilities in the ferrous field.

Ordnance Department Special Orders No. 283, dated December 3, 1940, in establishing the present Ferrous Metallurgical Advisory Board, listed the officers and members shown on page 608.

It is to be noted that the board contains members from the Navy Department, the Army Air Corps, and the National Bureau of Standards, and that the members from industry cover a wide field of experience in metallurgical matters of major interest to the Ordnance Department at this time. The president of the board and its secretary reside at Watertown.

*Commanding general, Watertown Arsenal, Watertown, Mass. President, Ferrous Metallurgical Advisory Board. Brigadier General, U. S. Army.

The secretary is director of the laboratory at Watertown Arsenal and is also a member of the Nonferrous Board at Frankford Arsenal. Similarly, the commanding general at Frankford Arsenal is president of the Nonferrous Metallurgical Advisory Board, and the officer in charge of the laboratory at that arsenal is a member of the Ferrous Metallurgical Advisory Board at Watertown Arsenal. This tie-in insures close coördination of the activities of the two boards. Representatives from interested Ordnance establishments usually attend meetings and participate in the discussions. It is also the policy to invite representatives from industry who may be especially qualified to assist in the solution of particular problems presented to the board.

MEETINGS are now called at comparatively frequent intervals as circumstances dictate under the emergency conditions. Technical research and development and problems bearing on production are absorbing a major part of the efforts of the board. It now serves largely as a clearing house for ideas and as a coördinating and directing unit for activities in which the Ordnance Department is vitally interested.

Obviously, due to the increase of responsibilities of the board, it can no longer function wholly as an operating agency. It is primarily a policy unit and must delegate some of its work to others. This is done by the creation of subcommittees for certain classes of ordnance material or special problems which cannot well be handled by the board itself. These subcommittees function under the general supervision of the board. In some cases, board members are also members of subcommittees for phases of the work in which they are especially qualified. Representatives from other interested arsenals and other branches of the Army, and from the Navy, also participate in subcommittee activities. In this way, maximum advantage is taken of experience, facilities, and qualifications which may be needed for the solution of the problems presented.

During the past year, the following metallurgical subcommittees have been organized:

Cast Armor (8 firms, 22 representatives); Armor Piercing Projectile and Bullet Core Steel (13 firms, 22 representatives); Rolled Armor (6 firms, 20 representatives); Welding of Armor (18 firms, 32 representatives); Helmet Steels (9 firms, 18 representatives); Aircraft Armor (18 firms, 32 representatives).

The large number of firms involved tends to insure more completely the full utilization of the technical competence and research facilities of industry for the defense program. The firms included in the subcommittees are engaged in the manufacture of the material in question or are primary sources or qualified suppliers.

Frequent subcommittee meetings are held at Watertown Arsenal, Aberdeen Proving Ground, and elsewhere. These subgroups bring together men in particular fields for the discussion of problems of mutual interest involving specifications, inspection methods, fabricating processes, requirements and capacities, and to advise and assist in the research-and-development program for particular materials or activities. Their services in these respects are invaluable. Examples of the work pursued are to be found in the development of high-quality cast armor during the past year and of armor-piercing-projectile and bullet-core steels. Investigation of suitable substitutes for strategic materials has been an important item in the research-and-development programs.

THE FERROUS METALLURGICAL ADVISORY BOARD

Brig. Gen. R. W. Case, Watertown Arsenal, Mass., *president.*
Mr. F. P. Gilligan, Henry Souther Engineering Company, Hartford, Conn., *vice-president.*
Lieut. Col. S. B. Ritchie, Watertown Arsenal, Mass., *secretary.*
Dr. H. L. Frevert, Midvale Steel & Ordnance Company, Philadelphia, Pa.
Mr. J. B. Johnson, Wright Field, Dayton, Ohio.
Mr. P. E. McKinney, Bethlehem Steel Company, Bethlehem, Pa.
Mr. F. F. McIntosh, Crucible Steel Company of America, Pittsburgh, Pa.
Mr. R. S. Archer, Republic Steel Corporation, Chicago, Ill.
Col. G. Elkins Knable, Ord. Res., Carnegie-Illinois Steel Corporation, Pittsburgh, Pa.
Mr. A. C. Badger, Youngstown Sheet & Tube Company, Youngstown, Ohio.
Dr. Lyman J. Briggs, National Bureau of Standards, Washington, D. C.
Mr. W. C. Hamilton, American Steel Foundries, East Chicago, Ind.
Dr. E. C. Bain, U. S. Steel Corporation, Pittsburgh, Pa.
Lieut. Comdr. Wallace S. Newton, Naval Gun Factory, Washington, D. C.
Mr. C. E. Margerum, Bureau of Ordnance, Navy Department, Washington, D. C.
Maj. L. S. Fletcher, Frankford Arsenal, Philadelphia, Pa.
Maj. D. J. Martin, Office, Chief of Ordnance, Washington, D. C.

ONE of the most significant activities of the subcommittees deals with research and development. Specific programs covering all phases of study deemed desirable to insure the very best material possible have been formulated and are under way. Definite parts of the programs are allocated to certain of the industrial firms best suited for the particular job. The activities are coördinated through Watertown Arsenal whose metallurgical laboratory collaborates in the work. The subcommittees, through the coöperative research-and-development programs, place at the disposal of the Department metallurgical talent and industrial facilities of the highest type. In turn, the Department is able to advise and assist industry in a way mutually beneficial to all concerned.

It is desired to point out here that the Metallurgical Subcommittee of the National Defense Research Council, a body of eminent scientists representative of university talent, is coördinating very closely with work of the Metallurgical Advisory Board. Through this organization, additional research facilities for the solution of defense problems, especially those of a basic nature, are being made available.

The services rendered by those who so freely coöperate and collaborate in the solution of ordnance problems are of inestimable value to national defense. It is a source of deep satisfaction to note that every one who has been asked to serve has done so with patriotic coöperation. Such enthusiasm is a vital factor in our national defense.

Battle Communications

THE speed and power of modern warfare have increased the demand and need for swift, reliable communication facilities under all conditions of combat. The new fast-moving armored divisions and motorized infantry require that commanders maintain constant contact with all units during an advance. Reconnaissance patrols must be able to report at once on enemy troop movements. Airplane pilots must be able to impart their observations to ground troops without delay. Communication lines are the nerves of the Army.

The Signal Corps has the task of providing, maintaining, and operating the principal communication facilities of the Army. The Corps is an arm with the combat duty of providing liaison for the units to which it is assigned; it is also a service in that it supplies the other arms and services with necessary equipment for their own communication systems and technically supervises the entire signal service of forces in the field. It also develops meteorological and photographic equipment for the Army, produces moving pictures for training purposes, and makes photographs for historical record.

A number of important developments have been made in the use of radio, but wire transmission still remains the basic means of signal communication—the telephone, teletype, and telegraph all being used for this purpose. Wire lines are laid in the battle area by cross-country wire-laying trucks and by the use of reels pulled or carried by Signal troops. These troops also repair the lines under fire.

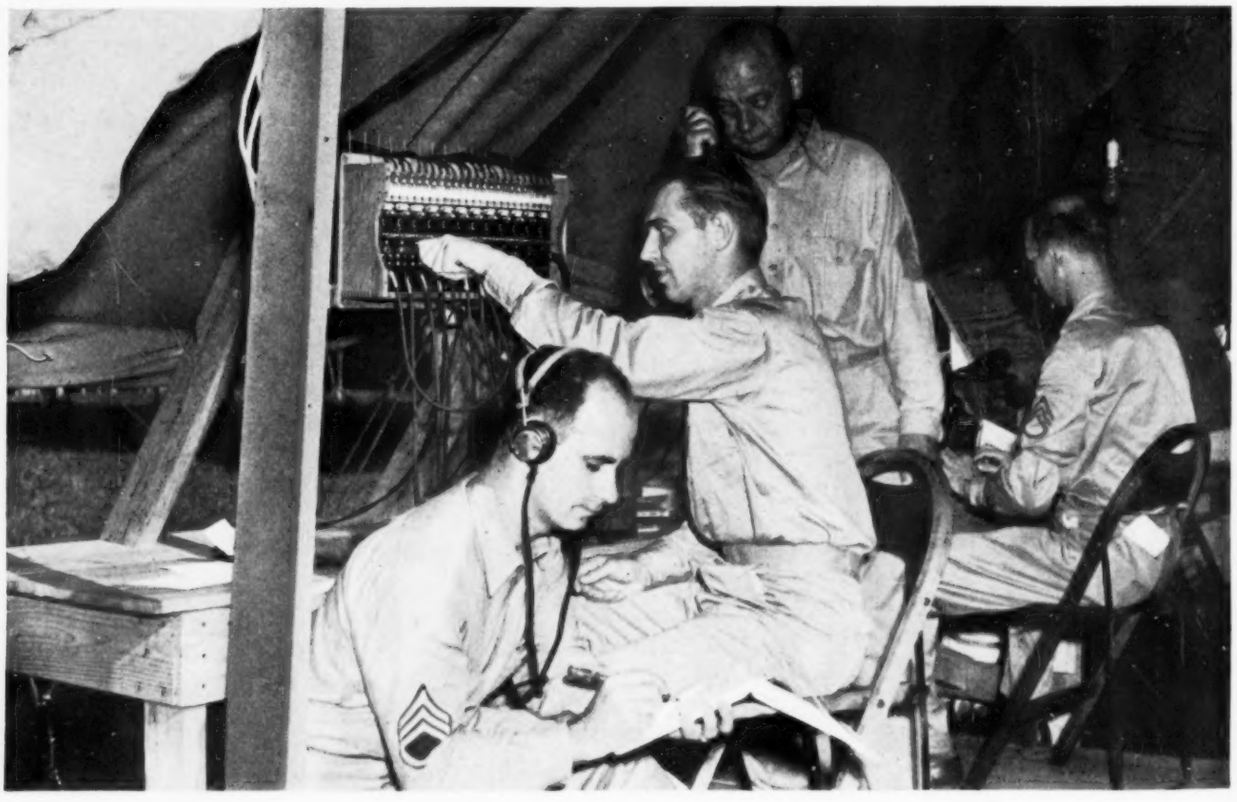
New radio developments by the Signal Corps include compact receiving and sending sets for tanks, scout cars, and aircraft. One of the most important advances is the "walkie-talkie" radio—a compact sending and receiving set which can be carried with ease by one man, as shown in the illustration on this page. Such a set may be advanced with combat troops under any conditions, enabling a commander in rear to direct isolated units toward a common objective. The Signal Corps also supplies special radio equipment for the Air Force including radio compasses and beacons.

Signal Corps troops with large units are composed of construction groups which install wire circuits and operating groups which operate messenger services, message-clearing centers, and signal equipment. Intelligence, photographic and pigeon units are among special Signal Corps troops assigned to field armies. The Signal intelligence units prepare codes and ciphers for our Army, intercept and decode enemy wire and radio messages, locate unauthorized or enemy radio stations, and supervise military radio traffic.

The organization has kept pace with the swift developments of modern warfare. The Corps operates an aircraft warning service to detect and report the approach of hostile aircraft. Communication facilities with numerous "listening posts" scattered over hundreds of miles of territory are installed or arranged and coordinated by the Corps—a major test of organization and equipment. The listening posts are prepared to spot the approach of enemy airplanes and relay this information to a central communications control point where instructions are teletyped to pursuit airdromes and antiaircraft units. Signal troops also have been assigned to aviation units and to the divisions of the Armored Force. (Illustrations on this page and the following pages are from Signal Corps photographs.)

Channels of Command

Wire transmission is the basic means of signal communication in the Army and is the most dependable, especially for permanent or semipermanent installations. Signal Corps soldiers, above, are laying ground wire from an outpost in a forward area to be connected eventually to the portable field telephone switchboard shown in operation in the illustration below.



Listening Posts of Defense

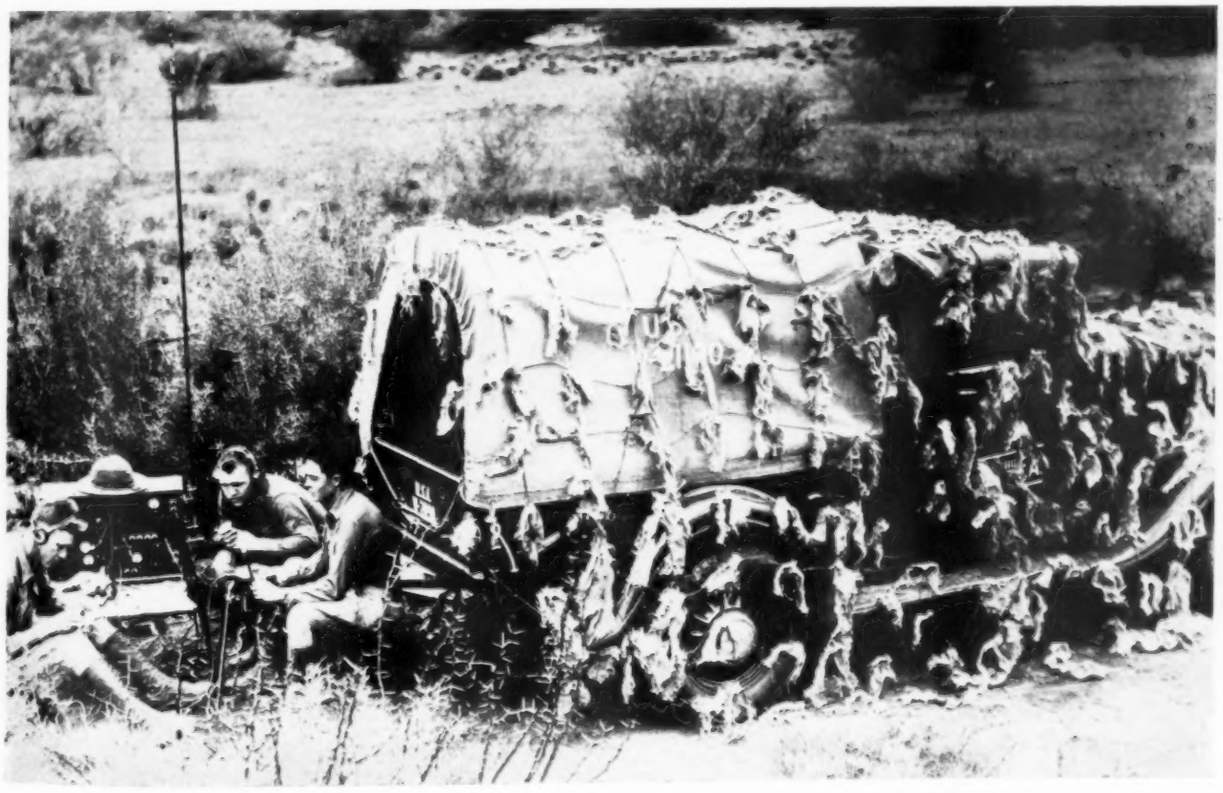
In areas farther to rear, the Signal Corps constructs pole lines for its telephone and telegraph wires, as above, or leases commercial wires, poles, and switchboards for military purposes. Men of the Aircraft Warning Service, operated by the Signal Corps, are shown below receiving flash messages by phone and teletyping instructions to airdromes and antiaircraft units.

Radio Control

Signal Corps radio developments have kept pace with the task of maintaining communications in our new mobile Army. The "walkie-talkie" sending and receiving set, shown above at a gun position, can be carried into action and operated by one man, while the radio-equipped command car, below, can receive reports and transmit orders while traveling at high speed.

Wireless Liaison

The air-ground liaison unit, above, is using a portable wireless-telegraph station with hand-powered generator to maintain contact with airplanes in flight. Below, soldiers of the 82nd Field Artillery have set up a similar station beside their camouflaged truck and are receiving orders during field maneuvers of the 1st Cavalry Division.

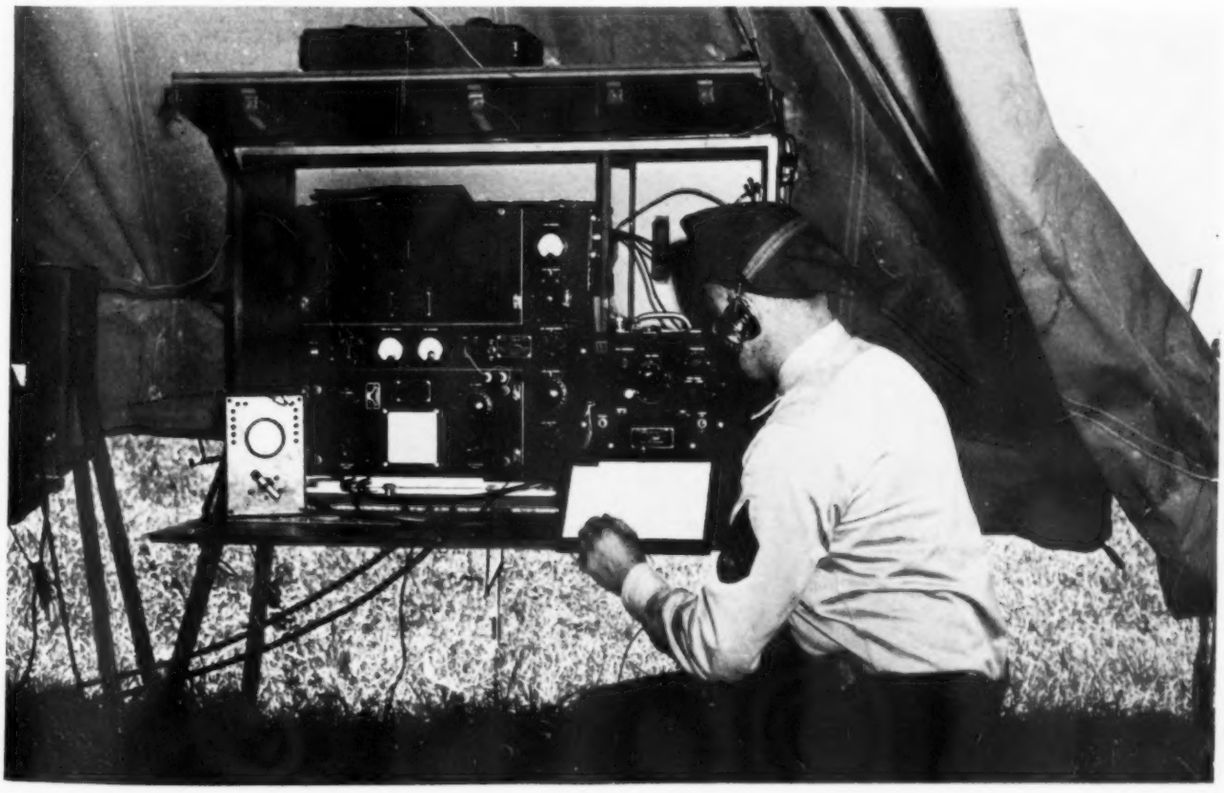


Message Carriers

When wires are blasted and radios silenced, the carrier pigeon can still get through with a message, so the Signal Corps breeds and trains these birds, like those shown above alighting at a mobile loft, while continuing the development of the most modern means of wire and wireless communication, such as the receiving-sending set shown below.

Mobile Communications

The Signal Corps wire crew, above, with their truck, portable switchboard, lance poles, and other telephone equipment, are making a temporary field installation. Below, a Signal Corps sergeant uses a modern instrument to check the frequencies of Army radio stations during maneuvers—an important task in keeping the lines of communication clear.



Training Films

Photography is an important Signal Corps function, particularly the production of training films used to show recruits how the various branches of the Army perform their particular duties. A Signal Corps motion-picture crew, above, get a close-up of Engineers constructing a ponton footbridge, while the film being made below will show the Infantry use of machine guns.

Planned Munitions

The Beginnings of the Armament Program of 1940

Lieut. Col. Henry S. Aurand *

THE supply system of the Army has three main functions: First, there must be a system of determining requirements—answers must be given to the questions: "What?" "How much?" "When?" Secondly, after the requirements are determined, the articles must be procured or otherwise acquired—answers must be found to the question: "Where and how will this equipment be obtained?" Thirdly, after the equipment has been delivered to the Army, it must be distributed—the question that must be answered is: "Where will it be utilized?"

In the War Department, as it is organized today, these three functions of supply are performed by eight different agencies known as the Supply Arms and Services. However, the division of the supply task among them is in no wise equal. Without arranging them in any particular order, they are called the Air Corps, the Ordnance Department, the Quartermaster Corps, the Medical Department, the Corps of Engineers, the Signal Corps, the Chemical Warfare Service, and the Coast Artillery Corps.

The activities of these eight agencies in connection with supply must be coördinated and supervised. Based on World War experience, the coördination and supervision of procurement is now assigned to the Under Secretary of War —of requirements and distribution, to the General Staff. The Under Secretary of War has an organization for this purpose, and the General Staff has G-4 (the Supply Division of the War Department General Staff). Naturally, G-4 and the Office of the Under Secretary must work closely together in the coördination and supervision of the supply functions of these eight Supply Arms and Services.

Except that the Under Secretary of War now handles procurement instead of the Assistant Secretary, these organizations have been in existence since the passage of the National Defense Act in 1920. They functioned fairly well for a small Army of less than 150,000 men and a National Guard of 225,000, and not only did they perform current supply functions but also made plans for supply in an emergency. These plans were based on the supply of forces of varying sizes up to 4,000,000 men. They contained the monthly requirements, the monthly expected production and the amount of stock necessary to bridge the gap until production alone could meet requirements. This amount of stock, together with equipment in the hands of the Regular Army and National Guard, was commonly referred to as the war reserve.

Prior to the outbreak of the war in Europe, two specific supply problems were being solved by this organization. The first was the problem of rearmament. Most of the material in war reserve was of World War vintage. Foreign nations were known to have developed improved equipment, but our scientists and inventors were equally capable of producing equipment not only as good as but better than that in the possession of foreign nations. With very limited funds, a program of development had been constantly under way since 1920. This development finally reached a point where rearmament was possible with improved equipment to be manufactured on a small scale, and small annual appropriations for rearmament were first obtained in 1933.

THE second supply problem which this organization handled prior to September 1939 was that of building up the war reserve. This was done by constantly cutting the size of the force for which a war reserve was to be held, until it reached the low point of 1,000,000 men, and by requesting funds to purchase for the war reserve only that equipment—known as "critical items"—which took a very long time to manufacture. By September 1939, this war reserve had been augmented to such an extent that it could be completed by an appropriation of $300,000,000.

It was with these plans in hand and estimates for funds to complete them in preparation that the supply organization of the War Department approached the critical days of the invasion of the Low Countries. When it became evident that this nation must greatly increase its preparations to defend itself, there was much public discussion as to the objective of such defense. Not until this objective was defined could any portion of the plans of the War Department be put into effect. When this question of the objective was put to Col. Henry L. Stimson, the Secretary of War, in a Congressional hearing on July 24, 1940, his reply in part was as follows: "So far as hemisphere defense is concerned, it seems to me the Congress had met that situation in passing a joint resolution in both Houses. In plain language, it notified the world, including Germany, that we should consider it detrimental to the peace and security of the United States if there should be any transfer of any holdings in this hemisphere from one outside nation to another outside nation. You even went further and said that if that was attempted or took place the United States not only would not recognize it, which is a diplomatic term, but you used the further expression, which is quite a good deal more forceful, that you would not acquiesce in it."

The size of the force required was described to a Senate committee by Gen. George C. Marshall, Chief of Staff, as follows: "We cannot tell what final strength will be required. If danger threatens this hemisphere we may require 3,000,000 men, 4,000,000, or more, because our obligations are scattered in so many directions . . . If we do not have equipment, we are lost . . . We are impotent to make our next progression in terms of man power until we have the required equipment . . . We have proposed that the critical items of equipment [be provided] for an army of 2,000,000, with the realization that the [1,200,000] force is not a sufficient force to achieve more than initial defense of continental United States."

These two statements reveal the objective for the War Department. This hemisphere must be defended. To this end, one of the necessary steps is to provide "critical items" for a ground army of 2,000,000 men.

*Chief, Requirements and Distribution Branch, Supply Division, War Department General Staff. Lieutenant Colonel (Ordnance) General Staff Corps.

While the objective was thus revealed in July 1940, it had been known to the War Department for some time. Existing plans required only slight change to adapt them to this objective. This adaptation can best be illustrated by a consideration of the events surrounding the passage of the various military appropriation bills.

THE regular 1941 Army appropriation bill was before Congress when it became necessary to increase our military effort. The immediate need was for larger proportions of those weapons which were proving so effective on the European battlefield. Fortunately, due to the rearmament project, there existed a practically complete shopping list of modern armament. It was unnecessary to do more than make a few relatively simple changes in the designs of these weapons. The quantities required were revised largely by adapting the proportions utilized in actual combat to our own organizations and objective. The original appropriation bill which provided for the completion of our rearmament and war reserve in a limited list of items was not changed and, from a first supplemental appropriation bill, funds were obtained for the revised quantities of critical items for a force of 1,000,000 men. These two bills also provided funds for the initial personnel increases which had been authorized by other legislation.

It was well known while these bills were under consideration that they represented but the first step in our military effort. The creation of the Advisory Commission to the Council of National Defense brought to the fore the question of the extent of the munitions effort for the fiscal year 1941. Between June 11 and June 28, 1940, there occurred a series of executive conferences involving the Army, Navy, Advisory Commission, Bureau of the Budget and the President. As a result, the munitions objective of the War Department was defined in more detail and approved for submission to Congress. It became known as the "Munitions Program of June 30, 1940," and was to accomplish the following:

(1) Procure all essential items of supplies to complete the equipment of the Protective Mobilization Plan force as revised (approximately 1,200,000 men) and to maintain that force on a combat status; (2) Procure all reserve stocks of the critical items of supplies needed to equip and maintain a ground force of approximately 2,000,000 men on combat status; (3) Create facilities for the production of the critical items of reserve stocks required to equip and maintain in combat approximately 2,000,000 men and create additional facilities requiring a long period of time to place in operation and needed for the expansion of the Army; (4) Procure 18,000 complete military airplanes (less the 2,181 planes for which funds have already been appropriated in the first supplemental national-defense appropriation act, 1941), together with necessary spare engines, spare parts, guns, radios and other supplies and accessories pertaining thereto; (5) Provide productive capacity available to the Army for 18,000 complete military airplanes per year, together with necessary engines and all other accessories and supplies pertaining thereto; (6) Provide necessary storage for the above items.

In a single twenty-four hours, existing mobilization plans were adapted to these new objectives. Three days later the complete shopping list had been computed and was submitted to the Bureau of the Budget on July 5th. On July 9th, the President presented this list, together with the Navy's requirements, to the Congress. The resulting appropriation act, known as the Second Supplemental, became law on September 9, 1940.

Subsequently, with the passage of the acts bringing the National Guard into Federal service and authorizing selective service, it was necessary to pass still another appropriation act to provide clothing and shelter for these additional forces. This appropriation act is known as the Third Supplemental.

IN THIS chronology, it is interesting to note the swiftness and sureness with which the War Department played its part. From its rearmament program, it had available designs for equipment more modern than prototypes in Europe. These designs generally required so little modification as to be immediately available for production. Its mobilization plan, revised early in 1940, was adapted to the munitions objective within twenty-four hours. And through its planning machinery, which had just computed the requirements for the regular 1941 appropriations, it was able in three days to prepare a shopping list to become known as the Munitions Program of June 30, 1940.

There remained in planning for this equipment the solution of three related problems: quantities to be procured in fiscal year 1941, priorities, and time objectives.

The Second Supplemental Appropriation Act did not carry sufficient funds to provide for the whole program. Of the $5,800,000,000 required, $3,900,000,000 was to be available in fiscal year 1941. It became necessary to determine what should be ordered from the funds available in fiscal year 1941 and what should be left for procurement from 1942 funds. In solving this problem, the items to be procured were divided roughly into three groups: (1) those items for which little industrial change was necessary, such as tractors; (2) those items for which great industrial change was necessary, such as tanks and antiaircraft guns; (3) those items for which no industry existed, such as ammunition-loading plants. The objective for all items was to provide productive capacity at the earliest practicable date.

Of the group for which little industrial change was necessary, procurement of the requirements for the force under arms was all that was necessary to insure sufficient productive capacity in industry. Consequently, procurement in fiscal year 1941 was limited to that amount, and the remainder deferred for procurement in fiscal year 1942. Of the group for which great industrial change was necessary, procurement of the entire amount in fiscal year 1941 would most quickly develop the necessary productive capacity. Consequently, all these items were set up for procurement in that fiscal year. Of the group for which a new industry must be created, it was obvious that orders for procurement would do little good. The plants for this industry had to be built first. The Second Supplemental Appropriation Act provided funds for building these plants. However, it was necessary to make contracts for the operation of these plants after their completion. For this purpose, a relatively small proportion of the total had to be ordered from fiscal year 1941 funds, leaving the remainder deferred for financing in fiscal year 1942.

From these considerations, a shopping list of the items to be procured from fiscal year 1941 funds was prepared. It is known as the expenditure program pertaining to the Munitions Program of June 30, 1940. It received final approval in mid-August and since that time has been changed to the extent of less than one-half of one per cent in money value.

All the changes made were suggested by the procurement agencies themselves, rather than by the line of the Army, and no further changes are contemplated—nor need any be made, as necessary adjustments can be made when the additional funds to complete the munitions program become available. Contrary to many contemporary statements in the press, the War Department has known all along what it wanted and has stuck to its shopping list.

NOT since the World War has the War Department had to consider the effect of its purchases upon industry, as they have been too insignificant. But from the lessons of the last war it knew that the large procurement required by the munitions program would have considerable industrial effect and that it was necessary to indicate the order in which things were required by means of priorities. The first of these priorities was merely a list of items in order of their importance to the armed forces. Using this list as a basis, a joint priority was worked out with the Navy Department. The resultant priorities were established by military objectives; for example, with regard to the Army, priority A-1 embraced the Regular Army, including Air Corps and National Guard, as authorized on July 1, 1940.

Priorities were first placed on contracts about August 1, 1940. Up to that time, appropriations for fiscal year 1941 were solely for those organizations in the A-1 priority. The natural result was that the great majority of these contracts bore the A-1 classification. The War Department knew that many times the amount of money then available to it was pending before the Congress and that contracts from this money would carry lower priority classifications. Unfortunately, this was not generally known, and the issuance of so many A-1 priority contracts caused a cheapening of this classification in industry. Subsequently, it has become necessary to break down the A-1 classification into smaller objectives, and there will undoubtedly be further changes. But a list of items in order of importance to the armed forces will continue to be the basis of priorities.

The expenditure program pertaining to the Munitions Program of June 30, 1940, contained the shopping-list information of what and how much was wanted. It did not contain an answer to the question: "When?" The answering of that question was one of the most difficult tasks in planning this equipment program. Several general time objectives had been indicated; for example, all equipment for the force of 1,200,000 by October 1, 1941, and for 2,000,000 by January 1, 1942. But from the industrial-mobilization plans on file in the War Department, it was quite obvious that all items could not be completed simultaneously. Some could be procured in advance of these general objectives, but others would take much longer to obtain. There was no use setting a time objective which was impossible of accomplishment.

To make the problem more difficult, foreign purchasers of munitions had already contracted with industry for some of the more important items. Quite generally, firms with such contracts were the ones upon which the War Department had counted for early production. There also was a good deal of secrecy about these contracts which made exact determinations difficult.

After lengthy study, time objectives were finally determined. A difficult goal was purposely set in order to provide an incentive for production. They were carefully labeled: "These are not delivery schedules." However, until delivery schedules became available, it was necessary to use them for that purpose. But regardless of the exactness of the dates, the time objectives do show the productive capacity in items per month which must be obtained, and this information has proved of the greatest value. Like the expenditure program, the statement of time objectives has not been changed since its approval just prior to the availability of funds from the Second Supplemental Appropriation Act. Again, although the contemporary press stated the contrary, the War Department had set up in time the answer to the question "When?" and has stuck by that answer without change. However, time objectives will have to be changed in the light of actual deliveries, and a new determination was anticipated during the first quarter of the calendar year 1941.

From a consideration of these facts it appears that, from the beginning of this emergency, the War Department has played its part without reorganization, has fully utilized its existing plans, has applied its World War experience to avoid errors, and is solving its problems with promptness and logic. Outside the slight difficulty with A-1 priorities, its solutions have proved sound so far. It is not unreasonable to assume that they will continue to do so as the Army's munitions program is continued toward completion.

EDITOR'S NOTE.—Carrying Colonel Aurand's discussion a step further, the allocation of the $7,000,000,000 provided by the Lease-Lend Act, approved March 12, 1941 (H.R. 1776) is of interest. These allocations are: (a) For the procurement, by manufacture or otherwise, of defense articles for the government of any country whose defense the President deems vital to the defense of the United States—including services and expenses in connection therewith, as follows: Ordnance and ordnance stores, supplies, spare parts, and materials, including armor and ammunition and components thereof—$1,343,000,000; aircraft and aëronautical material, including engines, spare parts, and accessories, $2,054,000,000; tanks, armored cars, automobiles, trucks, and other automotive vehicles, spare parts, and accessories, $362,000,000; vessels, ships, boats and other watercraft and equipage, supplies, materials, spare parts, and accessories, $629,000,000; miscellaneous military equipment, supplies and materials, $260,000,000; facilities and equipment for the manufacture or production of defense articles, including the construction, acquisition, maintenance and operation thereof, and the acquisition of land, $752,000,000; agricultural, industrial and other commodities and articles, $1,350,000,000; (b) For testing, inspecting, proving, repairing, outfitting, reconditioning, or otherwise placing in good working order any defense articles for the government of any country whose defense the President deems vital to the defense of the United States, $200,000,000—provided, that not to exceed twenty per cent of any of the foregoing appropriations may be transferred by the President to any other such appropriation, but no appropriation shall be increased more than thirty per cent thereby; and provided further, that any defense articles procured under the foregoing appropriations may be allocated by the President to any department or agency of this Government for the use of such department or agency; (c) For necessary services and expenses for carrying out the purpose of said act not specified or included in the foregoing, $40,000,000; and (d) For administrative expenses, $10,000,000.

As the armament program progresses, ARMY ORDNANCE will endeavor to record its future steps, as Colonel Aurand has done here for its beginnings, in order that the record may always be clear—and straight.

New Ordnance Medals to be Named for Distinguished Defense Leaders

The Army Ordnance Association, acting through its board of trustees and directors, has founded three new medals to be awarded for meritorious ordnance service. These medals will bear the names of the three outstanding Ordnance leaders in the United States whose works are here described. A committee on awards has been appointed by the president and will shortly announce the names of the three candidates to whom the awards will be presented for the first time this year.

BRIG. GEN. JOHN H. RICE

THE medal to be awarded for meritorious service to armament engineering will be named for the late Brig. Gen. John H. Rice, Chief Ordnance Officer of the A.E.F. during the World War, whose influence on ordnance engineering has had a profound effect, the results of which will continue for many years. General Rice was graduated from the United States Military Academy, a member of the Class of 1893. He was instructor of mathematics at the Academy from 1895 to 1897 and began his service in the Ordnance Department as an assistant to the Chief of Ordnance at Washington from 1906 to 1912. His great engineering service was begun during the World War as chief of the Carriage Division, which he reorganized and expanded. Later he was chief of the Engineering Division and subsequently became Chief Ordnance Officer of the American Expeditionary Forces in France. Following the World War he was Chief of Manufacture of the Ordnance Department. He was awarded the Distinguished Service Medal, Commander of the Legion of Honor (France), and the Army Ordnance Association Medal of Merit in 1932 for "meritorious service in the design, development and manufacture of military armament." General Rice was a charter member and a leading exponent in the establishment of the Army Ordnance Association. He always took a leading part in its deliberations, and, whether in active military service or, after his retirement, in private industry, he supported its aims with unfailing zeal. General Rice died January 7, 1940, at his home at Pelham Manor, N. Y.

COL. FRANK A. SCOTT

THE Scott medal for meritorious service to industrial preparedness will be in honor of Col. Frank A. Scott, a pioneer of industrial preparedness. First chairman of the War Industries Board in 1917 and, prior to that, organizer and first chairman of the General Munitions Board, Colonel Scott, by his broad knowledge, deep military learning, and unusual executive ability, gave to the infant science of industrial preparedness an impetus and standing which have brought untold benefits to the national defense of the United States. He was an organizer of the Army Ordnance Association and has served continuously on its board of directors since 1919. He was awarded the Army Ordnance Medal of Merit in 1932 "for leadership and administrative ability in the progress of American munitions preparedness." He has served as an adviser to the Army Industrial College since 1925 where his lectures and conferences have been among the great contributions to the development of industrial preparedness.

Underwood & Underwood

MAJ. GEN. WILLIAM CROZIER

THE Crozier medal will be awarded for meritorious service to the Army Ordnance Association. The name of Maj. Gen. William Crozier, renowned Chief of Ordnance of the Army from 1901 to 1918, needs no added honor from the Association. The Crozier influence on American armament and the national defense throughout more than half a century are synonymous with high purpose, sound engineering and leadership. General Crozier was graduated from the United States Military Academy a member of the Class of 1876. He became Brigadier General, Chief of Ordnance in 1901, Major General, Chief of Ordnance, in October 1917, and Major General, U. S. Army, July 12, 1918. He retired from active service January 1, 1919. His has been an outstanding record of ordnance achievement. With General Buffington he invented the Buffington-Crozier disappearing gun carriage. He also invented a wire-wrapped gun. He was a delegate to the International Peace Conference at The Hague in 1899, a member of the War Council, 1917-1918, and in the latter capacity served in the theater of operations in France and Italy from January to May 1918. In addition to the Army Ordnance Medal of Merit which he was awarded in 1932, General Crozier wears many honors, including those of France, Italy, and Poland. He is now a member of the board of directors of the Army Ordnance Association. A charter member of the society, he has contributed frequently to ARMY ORDNANCE and to other technical and scientific journals.

Rearmament Progress

Statistics of the Current Program

The following list of production contracts with private industry is published as further indication of the steady progress being made by the Ordnance Department of the Army in the production of military armament. Orders placed with Government arsenals and those below $25,000 are not included. These orders were placed during the period February 1, 1941, to April 5, 1941. For earlier orders under the military rearmament program, the reader is referred to the four preceding issues of this journal. The bulk of the appropriations for military armament have been converted into contracts, and production of these items is well under way. According to William S. Knudsen, director general, Office of Production Management: "In the 10 months we have been at it, we have placed something over $12,000,000,000 worth of work through the Army and Navy all over the country. We have handled or supervised the placing of $2,250,000,000 of construction of plants, $1,500,000,000 of which was financed by the Government and the balance privately financed on a Government guarantee. That comprises 784 projects . . . We have helped to place $750,000,000 worth of cantonments and camps . . . Today, the original program which we were given by the Army and the Navy is practically all in work, and we are now engaged in plotting out what is required under the Lend-Lease Bill."

Artillery Matériel and Components

Facility	*Amount*
Allegheny Ludlum Steel Corporation, West Leechburg, Pa	$ 56,395.55
Allis-Chalmers Manufacturing Co., La Porte, Ind	5,120,299.00
Aluminum Co. of America, Edgewater, N. J., and Massena, N. Y	101,902.61
American Rolling Mill Co., Middletown, Ohio	60,513.30
Detroit Bevel Gear Co., Detroit, Mich	47,528.25
Enterprise Tool & Gear Corporation, Detroit, Mich	164,085.00
Finkl & Sons Co., A., Chicago, Ill	44,200.00
Firestone Tire & Rubber Co., Akron, Ohio	80,268.00
International Harvester Co., Chicago, Ill	932,400.00
International Nickel Co., Huntington, W. Va	42,238.23
Mesta Machine Co., Pittsburgh, Pa	8,211,800.00
Otis Elevator Co., Buffalo, N. Y	47,296.54
Republic Steel Corporation, Canton, Ohio	241,455.70
Sier-Bath Co., New York, N. Y	32,826.00
Timken-Detroit Axle Co., Detroit, Mich	63,513.75
Warner Electric Brake Manufacturing Co., Beloit, Wis	59,991.75
Wellman Engineering Co., Cleveland, Ohio	7,024,200.00
Welsh, P. L., Davenport, Iowa	27,861.50
York Safe & Lock Co., York, Pa	2,955,582.00
Youngstown Sheet & Tube Co., Chicago, Ill	69,123.97

Artillery Ammunition and Components

Aluminum Co. of America, Massena, N. Y	$ 94,750.00
American Forge Division (American Brake Shoe & Foundry Co.), Chicago, Ill	111,600.00
American Gas Machine Co., Albert Lea, Minn	154,000.00
Atlas Powder Co., Ooltewah, Tenn	823,362.50
Bohn Aluminum & Brass Corporation, Detroit, Mich	566,950.00
Bossert Co., Utica, N. Y	690,000.00

Ordnance Production Contracts

Facility	*Amount*
Boston Woven Hose & Rubber Co., Cambridge, Mass.	$ 30,805.00
Bridgeport Brass Co., Bridgeport, Conn.	49,500.00
Chase Brass & Copper Co., Waterbury, Conn.	1,113,775.70
Cleveland Container Co., Philadelphia, Pa.	80,118.38
Cohn-Hall-Marx Co., New York, N. Y.	31,687.50
Diecasters, Inc., Ridgefield, N. J.	32,572.50
Duplan Silk Corporation, Hazleton, Pa.	360,740.00
Ever-Tite Manufacturing Co., Davenport, Iowa	58,710.28
Federal Screw Works, Detroit, Mich.	232,725.00
General Railway Signal Co., Rochester, N. Y.	38,360.00
Harding Machine Screw Co., East Liberty, Ohio	107,020.00
Kilby Steel Co., Anniston, Ala.	803,000.00
King Powder Co., Cincinnati, Ohio	29,361.00
LeTourneau Co., Toccoa, Ga.	1,190,000.00
Lonsdale Co., Providence, R. I.	294,310.00
Metal Specialties Co., Cincinnati, Ohio	760,972.00
Mueller Brass Co., Port Huron, Mich.	203,259.53
Murray Manufacturing Corporation, Brooklyn, N. Y.	142,680.00
National Cash Register Co., Dayton, Ohio	32,051.05
National Lock Washer Co., Newark, N. J.	44,752.00
Norwalk Lock Co., Norwalk, Conn.	30,454.50
Revere Copper & Brass, Inc., Chicago, Ill.	2,542,700.00
Scovill Manufacturing Co., Waterbury, Conn.	338,854.20
Seeley Tube & Box Co., Newark, N. J.	84,410.00
Titan Metal Manufacturing Co., Bellefonte, Pa.	352,596.00
Triumph Explosives, Inc., Elkton, Md.	455,000.00
Tungsten Electric Co., Union City, N. J.	38,250.00
Unique Specialties, Inc., New York, N. Y.	64,041.25
Winchester Repeating Arms Division (Western Cartridge Co.), New Haven, Conn.	35,805.00
Wolf Co., Chambersburg, Pa.	272,779.60
Worcester Taper Pin Co., Worcester, Mass.	36,300.48

Small-Arms Matériel and Components

Aërial Machine & Tool Corporation, New York, N. Y.	$ 29,250.00
American Steel & Wire Co. of New Jersey, Boston, Mass.	34,675.26
Auto-Ordnance Corporation, Bridgeport, Conn.	2,576,123.27
Colt's Patent Fire Arms Manufacturing Co., Hartford, Conn.	2,885,583.14
Conkey Co., W. B., Hammond, Ind.	36,986.00
Disston & Sons, Inc., Henry, Philadelphia, Pa.	26,200.40
Duplex Manufacturing Corporation, Sherman, N. Y.	54,821.25
Gilbert & Barker Manufacturing Co., West Springfield, Mass.	247,511.46
Hanssen's Sons, Louis, Davenport, Iowa	26,949.12
Howes Co., S. M., Boston, Mass.	33,264.12
Marks Co., S. B., Trion, Ga.	307,750.00
Morton Manufacturing Co., Chicago, Ill.	581,104.43
Pick Manufacturing Co., West Bend, Wis.	163,370.00
Remington Arms Co., Bridgeport, Conn.	29,922.81
Republic Steel Corporation, Massillon, Ohio	83,249.26
Rotary Electric Steel Co., Detroit, Mich.	26,341.20
Smith & Wesson, Inc., Springfield, Mass.	139,640.00
Uchtorff Co., Davenport, Iowa	368,862.60
Union Hardware Co., Torrington, Conn.	33,714.81
Union Steel Chest Corporation, LeRoy, N. Y.	76,367.16
Wallace Barnes Division (Associated Spring Corporation), Bristol, Conn.	72,946.80
Winchester Repeating Arms Division (Western Cartridge Co.), New Haven, Conn.	189,792.35

Ordnance Production Contracts

Small-Arms Ammunition and Components

Facility	*Amount*
Allegheny Ludlum Steel Corporation, Watervliet, N. Y.	$ 225,595.08
American Brass Co., Waterbury, Conn.	1,400,088.40
Bridgeport Rolling Mills Co., Bridgeport, Conn.	69,482.00
Carpenter Steel Co., Reading, Pa.	278,810.28
Peters Cartridge Division (Remington Arms Co.), Bridgeport, Conn.	253,468.53
Remington Arms Co., Bridgeport, Conn.	695,043.25
Revere Copper & Brass Co., Baltimore, Md.	240,672.00
Scovill Manufacturing Co., Waterbury, Conn.	84,000.00
Superior Sheet Steel Division (Continental Steel Corporation), Canton, Ohio.	59,200.00
Universal-Cyclops Steel Corporation, Bridgeville, Pa.	226,143.42
Western Cartridge Co., East Alton, Ill.	4,773,728.46

Bombs, Pyrotechnics, and Components

American Brake Shoe & Foundry Co., New York, N. Y.	$ 30,922.50
American Silk Spinning Co., Providence, R. I.	70,550.00
Atlas-Ansonia Co., New Haven, Conn.	59,400.00
General Textile Mills, Inc., Carbondale, Pa.	67,500.00
Stewart-Warner Corporation, Chicago, Ill.	601,180.79

Powder, Chemicals, and Explosives

Atlas Powder Co., Atlas, Mo.	$ 168,480.00
Barium Reduction Corporation, South Charleston, W. Va.	200,598.75
Bethlehem Steel Co., Bethlehem, Pa.	25,000.00
Du Pont de Nemours & Co., E. I., Barksdale, Wis.	149,200.00
Du Pont de Nemours & Co., E. I., Carney's Point, N. J.	29,130.00
Hercules Powder Co., Hopewell, Va., and Parlin, N. J.	427,000.00
Hercules Powder Co., Kenvil, N. J.	772,312.46
King Powder Co., King Mills, Ohio.	500,000.00
Magna Manufacturing Co., New York, N. Y.	224,623.50
Pfizer & Co., Charles, Brooklyn, N. Y.	71,747.00
Triton Chemical Corporation, Glen Wilton, Va., and Penns Grove, N. J.	175,000.00
Triumph Explosives, Inc., Elkton, Md.	202,950.00
Wah Chang Trading Corporation, New York, N. Y.	101,970.00

Combat Vehicles, Automotive Equipment, and Accessories

Bendix Westinghouse Automotive Air Brake Co., Pittsburgh, Pa.	$ 42,355.50
Continental Motors Corporation, Muskegon, Mich.	46,592.68
Eclipse Aviation Division (Bendix Aviation Corporation), Bendix, N. J.	316,692.00
Firestone Tire & Rubber Co., Akron, Ohio.	35,875.00
Harrison Radiator Division (General Motors Corporation), Lockport, N. Y.	27,861.60
Rockford Drilling Machine Division (Borg-Warner Corporation), Rockford, Ill.	59,301.70
Transue & Williams Steel Forging Corporation, Alliance, Ohio.	62,445.00
White Motor Co., Cleveland, Ohio.	284,124.00
Wisconsin Axle Division (Timken-Detroit Axle Co.), Oshkosh, Wis.	87,315.99
Wright Aëronautical Corporation, Paterson, N. J.	58,758.75

Fire Control

Baker & Co., Newark, N. J.	$ 251,865.60
Clark Leather Products Co., Chicago, Ill.	33,107.50
Elgin National Watch Co., Elgin, Ill.	54,529.84
Hobart Brothers Co., Troy, Ohio.	2,491,320.00

Ordnance Production Contracts

Tools and Machinery

Facility	*Amount*
Brown & Sharpe Manufacturing Co., Providence, R. I	$ 38,270.66
Clearing Machine Corporation, Chicago, Ill	50,300.00
Cleveland Automatic Machine Co., Cleveland, Ohio	71,534.45
Colton Co., Arthur, Detroit, Mich	120,617.00
Consolidated Machine Tool Corporation, Rochester, N. Y	167,470.00
Cummings Machine Works, Boston, Mass	35,700.00
Denison Engineering Co., Columbus, Ohio	26,490.00
Eclipse Aviation Division (Bendix Aviation Corporation), Bendix, N. J	27,680.27
Edwards Machinery Co., J. R., Newark, N. J	96,640.50
Electric Arc Cutting & Welding Co., Newark, N. J	31,460.00
General Machinery Corporation, Hamilton, Ohio	321,014.00
Hadley Special Tool Co., Boston, Mass	38,539.20
Ingersoll Milling Machine Co., Rockford, Ill	175,500.00
Jones & Lamson Machine Co., Springfield, Vt	148,677.25
Kent Machine Co., Grand Rapids, Mich	68,614.45
Kux-Lohner Machine Co., Chicago, Ill	106,390.00
Lindberg Engineering Co., Chicago, Ill	58,500.00
Machinery Builders, Inc., Long Island City, N. Y	26,685.92
Magnus Tool Co., Newark, N. J	50,369.00
New Britain Gridley Machine Division (New Britain Machine Co.), New Britain, Conn	181,032.00
Norton Co., Worcester, Mass	26,310.40
Reliable Tool Co., Irvington, N. J	31,950.00
Shipley Machinery Co., W. E., Philadelphia, Pa	317,371.39
Smithe Machine Co., F. L., New York, N. Y	51,620.00
Stokes Machine Co., F. J., Philadelphia, Pa	251,290.00
Swind Machinery Co., Philadelphia, Pa	33,240.00
Veit & Young, Philadelphia, Pa	45,988.50
Warner & Swasey Co., Cleveland, Ohio	27,689.00
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn	71,138.00
Williams & Co., J. H., Buffalo, N. Y	53,179.20

Gages

Modern Tool & Die Co., Philadelphia, Pa	$ 49,560.00
Pratt & Whitney Division (Niles-Bement-Pond Co.), West Hartford, Conn	125,359.40
Talon, Inc., Meadville, Pa	27,349.50

Facilities

Chandler Construction Co., Bridgewater, Mass	$ 110,500.00
Frazer & Co., H. B., Philadelphia, Pa	41,950.00
Germain Lumber Co., Pittsburgh, Pa	51,150.00
Hanssen's Sons, Louis, Davenport, Iowa	28,746.50
Hittner Electric Co., New York, N. Y	32,493.00
Ivory Pine Co., Bly, Oreg	28,513.13
Miller Lumber Co., George E., Redmond, Oreg	36,000.00
Parent Metal Products Co., Philadelphia, Pa	43,465.76
Patrick Lumber Co., Yakima, Wash., and Redmond, Oreg	27,650.00
Russell & Pugh Lumber Co., Springston, Ohio	69,000.00
Sharp Lumber Co., J. F., Seattle, Wash	33,700.00
Wyman Lumber Co., M. A., Seattle, Wash	118,068.47

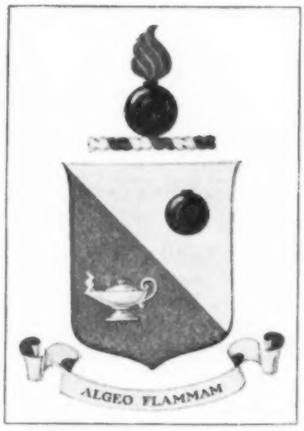
The Ordnance Training Center

The New Establishment at Aberdeen to Provide Skilled Officers and Men

Col. Julian S. Hatcher*

THE rapid expansion of the Army in the present emergency defense effort puts a tremendous premium on modern mechanical equipment and adequately trained men to use it. These two are inseparable, for neither has value without the other. The task confronting the Army, therefore, is twofold: the manufacture and procurement of equipment, and the training of men to use it. The training task is so tremendous that it cannot be accomplished by the usual methods and has called into existence an entirely new development called the "Ordnance Training Center." The idea was conceived by Maj. Gen. C. M. Wesson, Chief of Ordnance, and has been put into action to meet the definite need of providing a single agency to deal with all matters of Ordnance training.

The Ordnance Training Center is a great Army post which is being constructed at the Aberdeen Proving Ground, Md. It will be equipped to provide the entire Army with a sufficient number of trained men and companies of men to maintain and handle the supply of ordnance equipment and ammunition for all branches of the service, wherever they may be.



COAT OF ARMS OF THE ORDNANCE SCHOOL

The Ordnance Training Center consists of three separate and distinct units, each of which, in matters of certain special assignments, functions separately under its own commander and headquarters. For the ultimate objective, however, all are correlated under the commanding officer and headquarters of the Ordnance Training Center where they are bound together in an ever-interlocking program in which each is in turn dependent upon the other. These units are the Replacement Center, the Unit Training Center, and the Ordnance School.

The whole process of training begins when the selectees who have been earmarked for Ordnance arrive from the reception centers, one of which is located at Fort George G. Meade, Md. These men will be placed in the Replacement Center. The Replacement Center, approximating in size a brigade of 6,000 troops, has its own commanding officer and headquarters. Its physical property consists of barracks, recreation and administration buildings, designed to accommodate 6 battalions of 1,000 men each. There will be 4 companies of 250 men in each battalion. The buildings are arranged in distinct patterns or areas to permit each battalion to function as a self-contained entity. In the Replacement Center the selectees receive five weeks of intensive training in the basic school of the soldier and then eight weeks of general training in the special work of the Ordnance soldier.

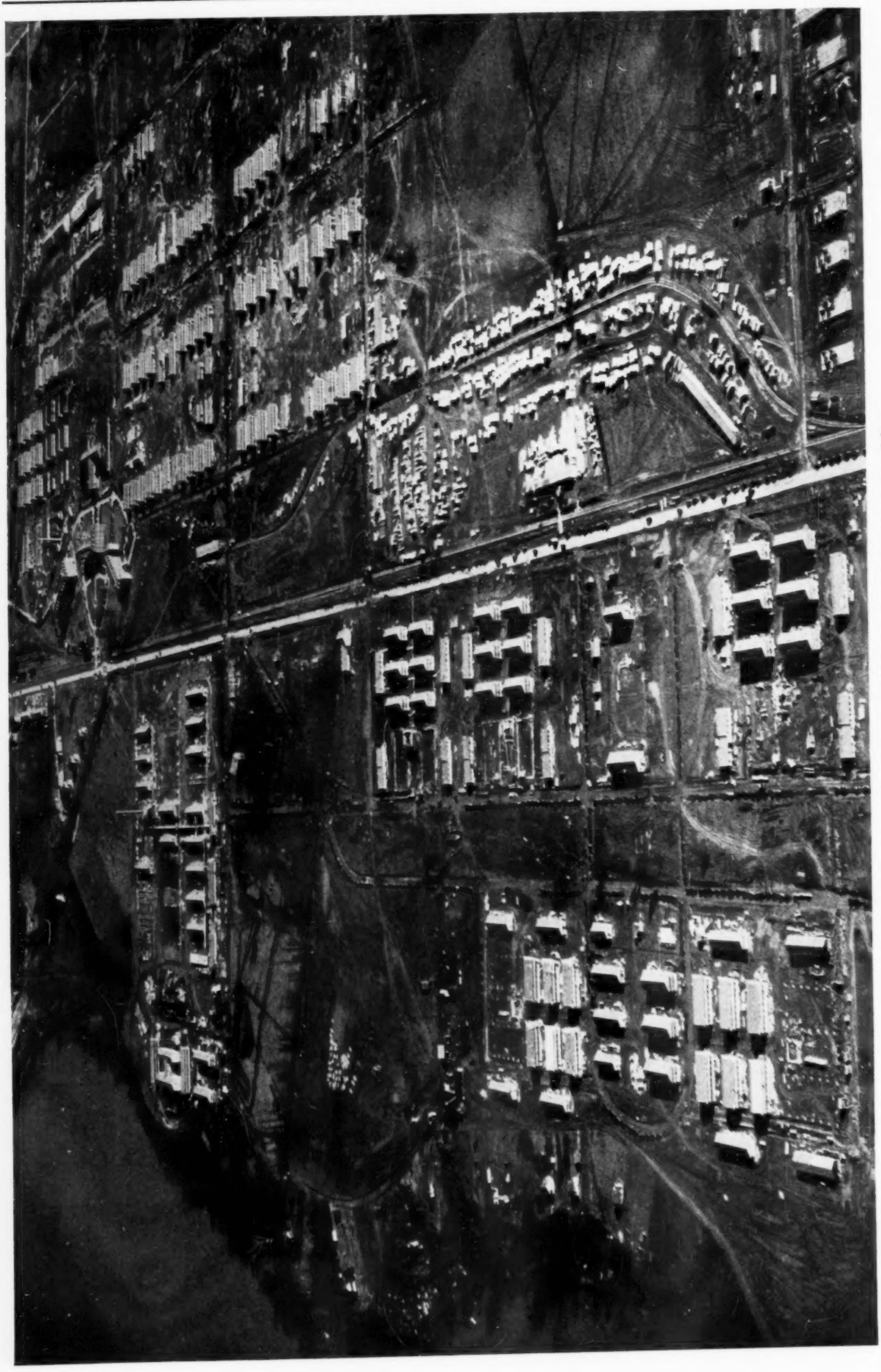
In former times, the raw recruit went directly from the reception center to the combat organization, where the maximum efficiency of that organization was impaired by the necessity of assigning personnel to train him. Today, a replacement center trains him before he arrives at his organization in the Army. It becomes a reservoir from which soldiers of minimum acceptable standards may be drawn in exact quantities as they are required. In an excellent article, entitled "Our Replacement Centers," which appeared in the January-February 1941 issue of the *Coast Artillery Journal*, the replacement center was compared to "the chain-store system wherein standard brands may be furnished wherever required." Standardization of training and flexibility of output were stressed as important characteristics of the replacement-center program.

After the first thirteen weeks, the Ordnance Enlisted Replacement Center is ready to supply replacements of trained men to the maintenance units in the four field armies, to the aviation units, the ammunition Ordnance unit training centers at Aberdeen Proving Ground, Raritan Arsenal, and Savanna Ordnance Depot, and to the GHQ [illegible] and wherever they [illegible] our greatly [illegible] fighting force will [illegible] more than replacements of individual men in units already organized. There will be need also for completely new maintenance units in Ordnance. Here is where the second section of the Ordnance Training Center—the Unit Training Center—comes into the picture.

THE Aberdeen Ordnance Unit Training Center is located in an area by itself with adequate housing, administration, and recreation buildings arranged to accommodate Ordnance maintenance companies of the size appropriate to their permanent function. The Unit Training Center will consist of 13 companies organized as follows: 10 medium-maintenance companies of 128 men each; 2 heavy-maintenance companies of 195 men each; and 1 railway-maintenance company of 77 men. Altogether, there will be approximately 2,500 men in the Unit Training Center organized into permanent units, each with its own officers, and all functioning under the supervision of the commanding officer of the Unit Training Center and his headquarters. The companies will be given intensive training and drilling for three months in the work of the maintenance unit before they are ready to be sent out to serve intact with one of the four field armies. Except for the efficiency and smoothness which only actual experience of years in the field can give, these new companies will be ready and able to give satisfactory service wherever they may be sent.

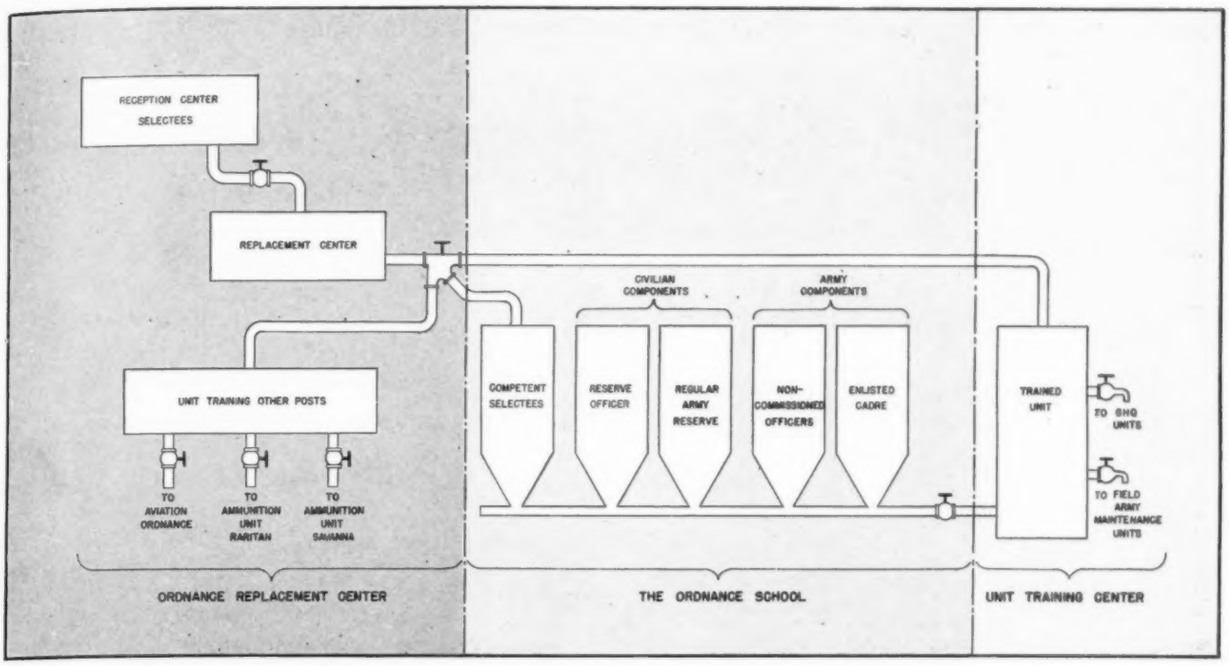
In order to provide the proper instructors and the tremendous number of qualified officers—commissioned and noncommissioned—for both the Replacement Center and the Unit Training Center, special consideration must be

*Commanding officer, Ordnance Training Center, Aberdeen Proving Ground, Md. Colonel, Ordnance Department, U. S. Army.



CAMP RODMAN—THE ORDNANCE TRAINING CENTER, ABERDEEN, MD.

The Ordnance School, with 1,500 students, occupies the group of buildings at upper right. Upper left is the partly completed camp hospital. Lower left is the Unit Training Center area, housing thirteen newly organized maintenance companies. On the right are shown two of the six battalion areas for the Ordnance Replacement Center. Aberdeen Proving Ground lies just beyond the top limits of the picture.



FUNCTIONS OF THE ORDNANCE TRAINING CENTER AT ABERDEEN

given to the third section of the Ordnance Training Center —the Ordnance School.

The Ordnance School is an old institution with a proud history of accomplishment in past years now turned to the important task of training trainers, instructing instructors, and providing cadres for the new companies referred to in the foregoing paragraphs. Organized under a new commandant and headquarters, the school already has trained one set of cadres and has begun to prepare the second. The school, in this respect, always must keep the supply of qualified instructors and cadres well ahead of the demand.

THE school provides refresher, basic, and specialist courses to meet the needs of those who are enrolled. The student body consists of specially selected Reserve officers, civilians, members of the Regular Army Reserve, enlisted cadres, noncommissioned officers, and others. The total enrollment reaches approximately 2,000 men. The average course of instruction lasts about three months.

The specialists' courses of instruction are planned to meet the needs of armorers, small-arms mechanics, artillery mechanics, automobile, tank, and tractor mechanics, carpenters, instrument repairmen, fire-control instrument men, machinists, welders, clerks, and cooks. These are, in the main, for those who engage in actual manual and mechanical work. There are, in addition, courses in maintenance, depot, and supply, which are supervisory in character. All are needed.

The Ordnance Training Center, comprising all three of these sections, coördinating their programs, correlating their activities, and controlling the flow of their personnel which is in a more or less constant state of flux (see chart), constitutes a major enterprise, and a vitally important one, in the life and plans of the Army as a whole. The Ordnance Training Center will approximate the strength of an Army division at all times—approximately ten to twelve thousand men. Located just outside the gate of the Aberdeen Proving Ground, it constitutes part of the command of Brig. Gen. J. B. Rose, who is also in command of the proving ground and the industrial area attached to it.

THE immediate command of the Ordnance Training Center as a separate and distinct project is vested in Col. Julian S. Hatcher, Ordnance Department. His staff and headquarters, with Maj. Harold J. Conway as executive officer, is that of an Army division. The commanding officers and principal assistants of the three component segments are as follows: Col. Bethel W. Simpson, commanding officer, and Lieut. Col. William I. Wilson, executive, Ordnance Replacement Center; Lieut. Col. George W. Outland, commandant, and Maj. John D. Billingsley, assistant commandant, Ordnance School; Lieut. Col. Herman U. Wagner, commanding officer, and Capt. A. R. Del Campo, executive, Ordnance Unit Training Center.

The idea of the Ordnance Training Center was conceived as the answer to a definite mass-production training need. It will cost approximately ten million dollars by the time the idea has become a reality in barracks, schools, warehouses, shops, mess halls, recreation buildings, hospital buildings, athletic fields, and theaters. When completed, it will be the Ordnance Training Center of the entire Army, a single agency, adequate to supply the highly specialized type of trained men who are needed to keep the fighting tools of the Army in working condition.

This is a day of ever-increasing mechanization, when war is waged more and more by machinery. In any battle, the victory will go to the army that has machinery which does not fail. The men who keep this machinery running become more and more indispensable and their production in ever-increasing numbers becomes a paramount factor in the building of an adequate defense. This fact alone makes the Ordnance Training Center something more than an emergency measure. It bids fair to become as permanent as the Army itself, for without it, in this day and age, the Army could scarcely exist. It is a new technique, in a new age, for a new Army.

Price Stabilization

A Necessity in a War Economy

Col. George Stuart Brady*

PRICE stabilization is a term so broad that for proper consideration it must be narrowed down to something more specific; namely, "price stabilization in a war economy." Such stabilization refers to a general control of prices of materials at their sources and, in our system, not to an attempt to control all goods or all avenues of trade. Narrowing the subject still further from this point, we will consider only certain principles.

Recently much has been heard about price control of certain strategic materials such as copper, zinc, and aluminum, and from the results in those few fields it is obvious that any effective price control necessarily must call for control and allocation of the quantities of the materials. But beyond these relatively few strategic materials, there are innumerable commodities which, though not the ones designated as the sinews of war, are nevertheless so bound up in the war economy of a machine-age struggle that the industries of a nation would be crippled without them.

The United States can control the few strategic materials and fix prices on them with little effect on the civilian economy. But we cannot possibly fight a modern machine war without an assurance that there will also be a steady flow of the hundreds of other raw materials that enter into the processes of industry. Judging by the experience with the few strategic materials, no government could control all materials of industry without exercising monopolistic powers as great as the dictatorships of Europe, unless the industries themselves coöperate willingly at the sources in voluntary agreements to employ the materials only with reasoning caution. Industry also must be willing to advance prices only when necessity requires such advances to keep the whole structure in balance.

Price is a name for the value at which the goods will be produced and circulated, and is a measure of the relative place a material has at a given time in the production of the goods.

PRICE fluctuations are the surface indications of economic disturbances due to shortages of commodities, difficulties in production, restriction of distribution, or other factors which, in a war economy where goods must be delivered at a certain point in the shortest possible time, might easily have disastrous military results. Therefore, price stabilization in a war economy does not mean that the Government is trying to prevent some traders from getting rich by charging as high prices as the "supply and demand" will permit them—that is highly important only because its control helps to stabilize the civilian morale. The prime worth of price stabilization is an orderly and disciplined organization of the channels of industrial production.

Price stabilization does not mean holding prices at fixed levels. According to the best dictionaries, the word stabilize means "to produce or maintain the equilibrium or balance." Thus, with changing economic conditions such as higher labor costs, increased ocean rates, and difficulties in production, prices may go up justifiably. But if we are to prevent the chaos that comes when the economic disturbances of a world war cause thousands of products to be affected simultaneously by all these factors, then it is just as vital for the welfare of the complex industrial system to have some form of economic control as it is for the fighting forces to have regulatory measures.

IN A HIGHLY democratic nation where business is accustomed to glorify its so-called "free competitive system" and traders can hoard at will or take advantage of dire shortages, and where normally the readjustments and controls take years to be effected, the economics of the industrial system are extremely explosive. A mad cycle of speculation and hoarding begins at once if fears are not allayed at the outset by a knowledge that the cycle is being watched and guarded.

In the last war we allowed these things to happen, and then we came in too late and set prices at high levels, thus crystallizing the economic errors into an unbalanced system. We made terrible economic mistakes in the past; we cannot afford to make them again. In the last war, Germany was a small economic unit, shut off on both sides. The British, American, and Japanese fleets ruled the seas. The airplane and the submarine were not yet efficient weapons. Today, no such conditions exist. Germany is a powerful economic unit with the materials and resources of France and Scandinavia at her disposal, with vital materials coming in from South America and Africa through western open ports, and vast quantities of Asiatic materials coming in through Russia and up from the Near East. In addition, she has western ports almost surrounding the most populous section of the single important battleground of her opponents. The belief that the many neighboring nations will not long serve her needs in raw materials and work their industries for her is an idle dream.

Today our country faces a problem a hundred times more difficult than in the World War. We could afford to make many mistakes then because we faced an enemy weakened by three years of war and starvation. But I am afraid that too large a proportion of our business men are overconfident of our ability to defend ourselves today and are thus not inclined to make the sacrifices necessary to prevent a rigid control later. Our press was entirely wrong in its judgment of the situation a year ago, and I believe that it is wrong now in feeling that anyone who dares to face the truth and prepare for a tough battle is a defeatist.

The greatest economic disturbances in our industrial program this year are likely to be made because of shortages of many materials now coming wholly or in part from overseas. The Army lists less than one hundred strategic and critical materials, but actually there are more than 100,000 raw materials that enter into the complexities of American industrial life. Without an adequate regular supply of hundreds of these materials our price relationships will go to pieces. But then it will be too late to remedy the situation,

*Chief, Substitute and Secondary Materials Section, Price Stabilization Division, National Defense Advisory Commission. Colonel, Ordnance Reserve, U. S. Army.

for the price instability follows the economic error. We are too prone to think in terms of a few strategic materials, without realizing that our industries cannot function normally without the many other incidental materials. The buyer of tin plate never sees, and probably never hears of, the palm oil from the East Indies that is necessary in making the plate. Our industries will certainly be hampered and slowed up if we are compelled to stop and find substitutes and new methods of processing our products.

Recently I examined in detail the parts that make up one relatively small but important machine. That machine required raw materials from forty-five different countries on all continents. It could be made with less, but it would be clumsier, more costly, and would require redesign and change of manufacturing processes. The attitude of nonchalance with which many people, even in high places, dismiss as unimportant the questions of supply and price of these innumerable secondary materials is greatly disturbing. In normal times it takes months to effect changes in machine models in our industrial system. It requires new set-ups and the training of workers in new procedures. If temporary chaos is produced in a factory by making the routine changes of normal times, how much greater will be the chaos if all industry is called upon to make hundreds of substitutions simultaneously under the stress of war conditions.

TO FOLLOW merely the experience of the World War would be disastrous. Early in the present emergency the President set up a Price Stabilization Division. If, in view of our past experience, we should interpret the duty of that division as merely to protect John Consumer from being held up for high prices by a few profiteers, then I would say that we learned nothing about economic warfare from the last war. In the three years of that conflict before we introduced price control, prices went up to mad levels. Part of this rise was due to deliberate speculation. But most of it was due to the fact that there was lack of adequate control or planning in the avenues of supply of the materials. The chaotic prices were only an outward sign of the disease below. We not only did not plan in advance for the material supplies, but we permitted them to be wasted in unbalanced production of many commodities.

Today, happily, the Army is placing contracts for definite quantities of goods, and no company is authorized to produce more than the quantity ordered in a given time. In the last war there was much confusion despite the books of economic fairy tales published afterward. Then it was that the Army term, "horsefeathers," originated, for we had more than forty currycombs for every horse and mule in the Army! In 1918, we gave open orders to firms for the production of commodities, and no man dared stop the production of some things to put the effort on others, even though we were ten years ahead on some items with dire shortages on others. Take spruce as an example. When the Armistice was signed, we had an army of men in the northwestern forests cutting spruce. Enough spruce had been cut to build 250,000 airplanes, but we built less than 12,000 planes, and we were soon to abandon spruce as a raw material for airplane construction. But the price of spruce had been boosted up to $175 a thousand feet! The supply of malleable iron grenades was two years ahead of any possible schedule for loading them. We were beginning to get deliveries on woolen socks at the rate of 200 pairs per soldier per year, while the War Industries Board was complaining of a wool shortage!

IN A FUTURE emergency no one can afford to make the mistake of thinking that production is the only measure of patriotism. In the last conflict our war expenses climbed in a parabolic curve from $2,000,000 a day to $2,500,000 an hour, and were rapidly pointing toward $4,000,000 an hour. And the money was not flowing through a sieve, but into the narrow guides of an industrial slot machine that produced more than 20,000 new millionaires in a year.

What happened to prices? Cotton fabrics were fixed in price in the summer of 1918 at about three times what they brought before the war. Tanning materials from overseas rose as much as 600 per cent. Leather cost the Government about eighty cents a pound, three times its value, though we never had a real shortage. Much material was wasted in superproduction.

The United States imports from the Far East more than 200 materials vitally necessary in our industrial economy. Some of these can be replaced in whole or in part with materials from South America. But it would be necessary to transfer boats from the Far East if, for example, babassu oil was to be brought from Brazil instead of coconut oil from the Dutch East Indies and the Philippines. Incidentally, we import 2,500,000 tons of vegetable oils a year that are necessary in our industries for paints, leather dressings, soaps, and foods. Tung oil from China can be replaced with oiticica oil from Brazil, but it means organizing the Brazilian industry for greater production and transferring ships. In the case of some substitutes it will be necessary to introduce new techniques and different manufacturing methods into our industries. In all this, price is the index or the symptom through which we are able to ferret out many troubles and bottlenecks. Several cases have occurred recently in which getting to the bottom of the causes of price rises has clearly shown the real procurement bottleneck.

In a huge program of economic warfare, where the ideal is to see that one's own industries are amply supplied and the enemy's cut off, price must be looked upon as a symptom, and price stabilization as the economic doctor's medicine. Medicines are often poisons. Their great value lies in just that point. For when a particular organ is overtaxed or undernourished, a regulated dose of a poisonous drug may give the necessary stimulation to restore health.

Price stabilization, like medicine, may be considered by many as something to keep away from as long as possible, but it is also something which, when applied in moderation at the outset, may eliminate the necessity for large doses later. Price stabilization is not production, any more than medicine is food, but it requires facts and figures affecting things behind the symptoms. It often requires prying into the other fellow's business to get those facts and figures far enough in advance to do some good. Price stabilization was not adopted in the last war until the disease was far advanced. The doctor gets no credit for a cure if by early action he prevents a serious illness.

In the present emergency, the Administration has set up a price-stabilization doctor. It is his job to watch the symptoms and dose the patient. Intelligent price stabilization in our vast and complex industrial system cannot be accomplished by sitting back and waiting for the prices to rise to such levels that the patient screams in distress. The job is to pry into the causes, to apply the stethoscope—and to dissect if necessary. In this emergency, we must diagnose our economic disorders well in advance, and in this diagnosis price stabilization is an important instrument.

Ordnance Field Service

The Army's System of Armament Maintenance and Supply

ON THESE pages are published the organizations of the Ordnance Field Service in the Army of the United States. Designations of the various units are given, together with their stations. These are the military units of the Ordnance Department attached to the various fighting forces. They are divided into six principal classifications: (1) Those attached to training centers (Tng.) and proving grounds (PG)—shown in white on the map facing page 632; (2) Maintenance units, heavy (HM) and medium (MM)—shown in red; (3) Depot companies—shown in green; (4) Ammunition (AM)—in yellow; (5) Aviation (Avn.)—in blue; and (6) Service—in grey. The function of all is to supply and maintain the equipment of the fighting organizations to which they are attached.

The following list is arranged in conjunction with the map mentioned above. Unit designations correspond with the numbers on the map and in this list (except units not in the United States). This list and map complement the list and map entitled "Organization for Production" which was published in the last issue of ARMY ORDNANCE *(Vol. XXI, No. 125, March-April 1941). Together they form a visual representation of the two great functions of the Ordnance Department in the Army of the United States: (1) design and production—the function of the Industrial Service, Ordnance Department; and (2) military supply and maintenance—the function of the Field Service, Ordnance Department. The maps also are visual evidence of the expanding ordnance operations both in industry and in the Army.*

Organization	Assignment	Station
1. 1st Ordnance Company (MM)	10th Ordnance Battalion (Maintenance & Supply), First Army	Madison Barracks, N. Y.
1 S. 1st Ordnance Service Company	First Corps Area	Headquarters, Boston, Mass.
2. 2nd Ordnance Company (MM)	8th Ordnance Battalion (Maintenance), VIII Corps (Third Army)	Fort Sam Houston, Tex.
2 S. 2nd Ordnance Service Company	Second Corps Area	Headquarters, 90 Church Street, New York, N. Y.
3. 3rd Ordnance Company (MM)	9th Ordnance Battalion (Maintenance), IX Corps (Fourth Army)	Fort Lewis, Wash.
3 S. 3rd Ordnance Service Company	Third Corps Area	Headquarters, Baltimore, Md.
4. 4th Ordnance Company (MM)	3rd Ordnance Battalion (Maintenance), III Corps (Fourth Army)	Fort Ord, Calif.
4 S. 4th Ordnance Service Company	Fourth Corps Area	Headquarters, Atlanta, Ga.
5. 5th Ordnance Company (MM)	6th Ordnance Battalion (Maintenance), VI Corps (First Army)	Camp Edwards, Mass.
5 S. 5th Ordnance Service Company	Fifth Corps Area	Headquarters, Fort Hayes, Ohio
6. 6th Ordnance Company (MM)	GHQ	Fort Monroe, Va.
6 S. 6th Ordnance Service Company	Sixth Corps Area	Headquarters, Chicago, Ill.
7. 7th Ordnance Company (MM)	13th Ordnance Battalion (Maintenance & Supply), Fourth Army	Camp Haan, Calif.
7 S. 7th Ordnance Service Company	Seventh Corps Area	Headquarters, Fort Omaha, Nebr.
8. 8th Ordnance Company (MM)	GHQ	Fort Bragg, N. C.
8 S. 8th Ordnance Service Company	Eighth Corps Area	Headquarters, Fort Sam Houston, Tex.
9. 9th Ordnance Company (MM)	12th Ordnance Battalion (Maintenance & Supply), Third Army	Fort Sill, Okla.
9 S. 9th Ordnance Service Company	Ninth Corps Area	Headquarters, Presidio of San Francisco, Calif.
10. 10th Ordnance Company (MM)	Panama Canal Department	Corozal, C. Z.
11. 11th Ordnance Company (MM)	Hawaiian Division	Schofield Barracks, T. H.
11 S. 11th Ordnance Service Company	U. S. Military Academy	West Point, N. Y.
12. 12th Ordnance Company (MM)	Philippine Division	Fort Stotsenburg, P. I.
13. 13th Ordnance Company (MM)	13th Ordnance Battalion (Maintenance & Supply), Fourth Army	Camp Hulen, Tex.
14. 14th Ordnance Company (MM)	GHQ	Camp Livingston, La.
15. 15th Ordnance Company (MM)	10th Ordnance Battalion (Maintenance & Supply), First Army	Fort Bragg, N. C.
16. 16th Ordnance Company (MM)	GHQ	Camp Stewart, Ga.
17 B. 17th Ordnance Battalion (Armored Division)	GHQ, 2nd Armored Division	Fort Benning, Ga.

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Organization	Assignment	Station
18. 18th Ordnance Company (MM)	3rd Ordnance Battalion (Maintenance), III Corps, (Fourth Army)	Camp Haan, Calif.
18 B. 18th Ordnance Battalion (Armored Division)	GHQ, 3rd Armored Division	Camp Polk, La.
19 B. 19th Ordnance Battalion (Armored Division)	GHQ, 1st Armored Division	Fort Knox, Ky.
20. 20th Ordnance Company (MM)	Panama Canal Department	Corozal, C. Z.
20 B. 20th Ordnance Battalion (Armored Division)	GHQ, 4th Armored Division	Pine Camp, N. Y.
21. 21st Ordnance Company (MM)	GHQ	Camp Stewart, Ga.
22. 22nd Ordnance Company (MM)	11th Ordnance Battalion (Maintenance & Supply), Second Army	Fort Leonard Wood, Mo.
23. 23rd Ordnance Company (MM)	11th Ordnance Battalion (Maintenance & Supply), Second Army	Fort Sheridan, Ill.
24. 24th Ordnance Company (MM)	GHQ (2nd Cavalry Division)	Fort Riley, Kans.
25. 25th Ordnance Company (MM)	GHQ	Camp Hulen, Tex.
26. 26th Ordnance Company (MM)	12th Ordnance Battalion (Maintenance & Supply), Third Army	Fort Bliss, Tex.
27. 27th Ordnance Company (MM)	GHQ (1st Cavalry Division)	Fort Bliss, Tex.
28. 28th Ordnance Company (MM)	4th Ordnance Battalion (Maintenance), IV Corps (Third Army)	Fort Oglethorpe, Ga.
29. 29th Ordnance Company (MM)	6th Ordnance Battalion (Maintenance), VI Corps (First Army)	Fort Devens, Mass.
30. 30th Ordnance Company (HM—Tanks)	GHQ	Fort George G. Meade, Md.
31. 31st Ordnance Company (HM—Field Army)	12th Ordnance Battalion (Maintenance & Supply), Third Army	Fort Benning, Ga.
32. 32nd Ordnance Company (MM)	GHQ	Fort Bragg, N. C.
33. 33rd Ordnance Company (MM)	Puerto Rican Department	Fort Buchanan, P. R.
34. 34th Ordnance Company (MM)	1st Ordnance Battalion (Maintenance), I Corps (First Army)	Fort Bragg, N. C.
35. 35th Ordnance Company (MM)	1st Ordnance Battalion (Maintenance), I Corps (First Army)	Fort Jackson, S. C.
36. 36th Ordnance Company (MM)	GHQ	Camp Forrest, Tenn.
37. 37th Ordnance Company (MM)	GHQ	Camp Shelby, Miss.
38. 38th Ordnance Company (MM)	GHQ	Camp Davis, N. C.
39. 39th Ordnance Company (MM)	GHQ	Camp Davis, N. C.
40. 40th Ordnance Company (Tng.)	Ordnance School	Aberdeen Proving Ground, Md.
41. 41st Ordnance Company (Depot)	Panama Canal Department	Corozal, C. Z.
42. 42nd Ordnance Company (Am)	Puerto Rican Department	Puerto Rican Department, P. R.
44. 44th Ordnance Company (PG)	Aberdeen Proving Ground	Aberdeen Proving Ground, Md.
45. 45th Ordnance Company (MM)	GHQ	Camp Davis, N. C.
46. 46th Ordnance Company (MM)	GHQ	Fort Custer, Mich.
47. 47th Ordnance Company (MM)	GHQ	Fort Ethan Allen, Vt.
48. 48th Ordnance Company (MM)	9th Ordnance Battalion (Maintenance), IX Corps (Fourth Army)	Fort F. E. Warren, Wyo.
50. 50th Ordnance Company (Am)	14th Ordnance Battalion (Ammunition), First Army	Fort Jackson, S. C.
51. 51st Ordnance Company (Am)	14th Ordnance Battalion (Ammunition), First Army	Delaware Ordnance Depot, N. J.
52. 52nd Ordnance Company (Am)	15th Ordnance Battalion (Ammunition), Second Army	Savanna Ordnance Depot, Ill.
53. 53rd Ordnance Company (Am)	GHQ	Fort Knox, Ky.
54. 54th Ordnance Company (Am)	14th Ordnance Battalion (Ammunition), First Army	Fort Bragg, N. C.
55. 55th Ordnance Company (Am)	23rd Ordnance Battalion (Ammunition), Fourth Army	Fort Lewis, Wash.
56. 56th Ordnance Company (Am)	14th Ordnance Battalion (Ammunition), First Army	Nansemond Ordnance Depot, Va.
57. 57th Ordnance Company (Am)	26th Ordnance Battalion (Ammunition), Third Army	Camp Blanding, Fla.
58. 58th Ordnance Company (Am)	14th Ordnance Battalion (Ammunition), First Army	Raritan Arsenal, N. J.
59. 59th Ordnance Company (Am)	16th Ordnance Battalion (Ammunition), Third Army	Fort Sill, Okla.
60. 60th Ordnance Company (Am)	26th Ordnance Battalion (Ammunition), Third Army	Camp Livingston, La.
61. 61st Ordnance Company (Am)	Hawaiian Department	Hawaiian Ordnance Depot, T. H.
62. 62nd Ordnance Company (MM)	Hawaiian Department	Hawaiian Ordnance Depot, T. H.
63. 63rd Ordnance Company (MM)	Hawaiian Department	Hawaiian Ordnance Depot, T. H.
64. 64th Ordnance Company (Am)	26th Ordnance Battalion (Ammunition), Third Army	Camp Shelby, Miss.
65. 65th Ordnance Company (Am)	GHQ	Fort Benning, Ga.
66. 66th Ordnance Company (Am)	15th Ordnance Battalion (Ammunition), Second Army	Camp Forrest, Tenn.
67. 67th Ordnance Company (Am)	14th Ordnance Battalion (Ammunition), First Army	Camp Stewart, Ga.
68. 68th Ordnance Company (Am)	16th Ordnance Battalion (Ammunition), Third Army	Fort Bliss, Tex.
69. 69th Ordnance Company (Am)	24th Ordnance Battalion (Ammunition), First Army	Camp Edwards, Mass.
72. 72nd Ordnance Company (Depot)	12th Ordnance Battalion (Maintenance & Supply), Third Army	Fort Benning, Ga.
73. 73rd Ordnance Company (Depot)	GHQ	Fort Knox, Ky.
74. 74th Ordnance Company (Depot)	Hawaiian Department	Hawaiian Ordnance Depot, T. H.

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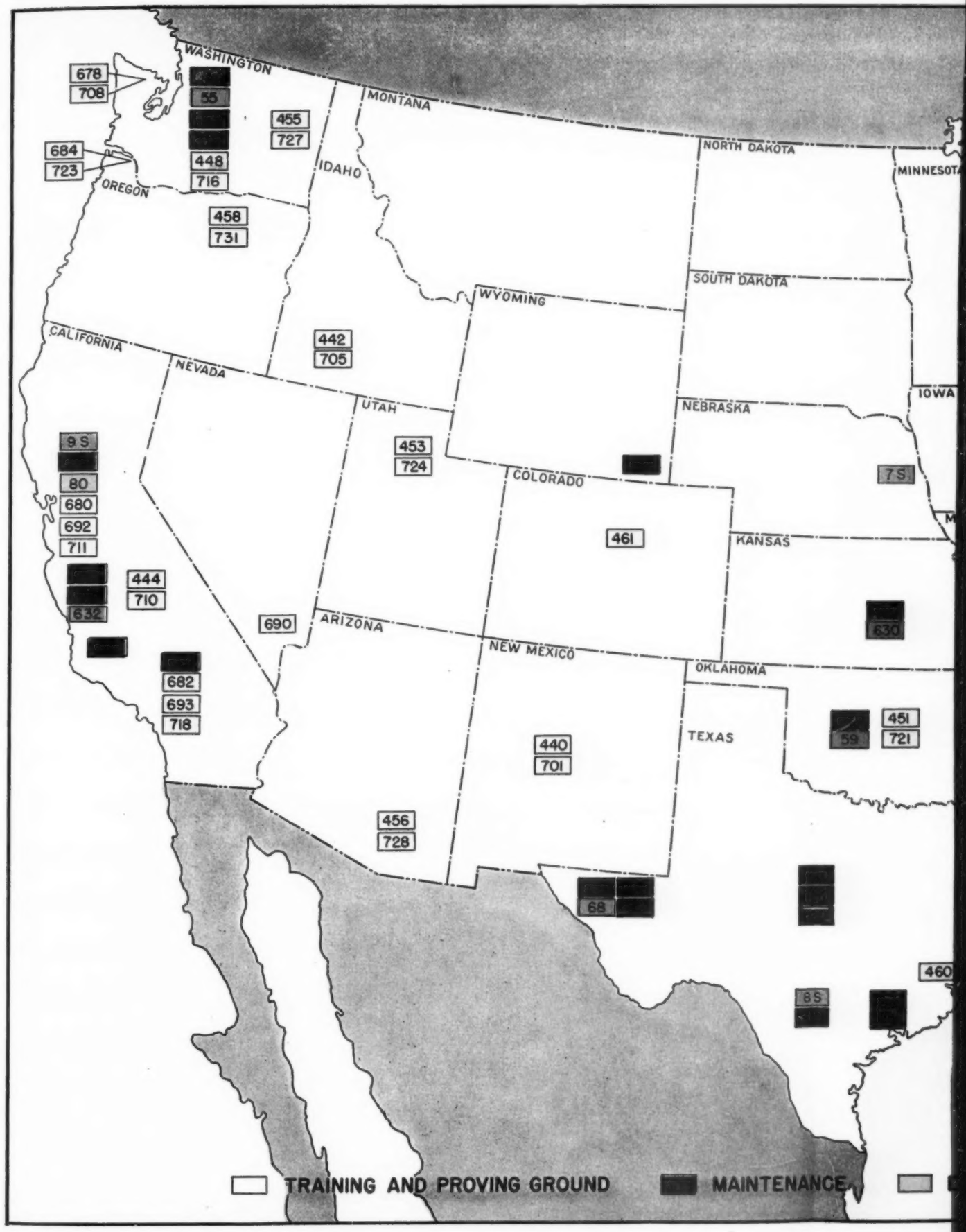
Organization	Assignment	Station
75. 75th Ordnance Company (Depot)	Philippine Department	Philippine Ordnance Depot, P. I.
79. 79th Ordnance Company (Depot)	10th Ordnance Battalion (Maintenance & Supply), First Army	Augusta Arsenal, Ga.
80. 80th Ordnance Company (Depot)	13th Ordnance Battalion (Maintenance & Supply), Fourth Army	Headquarters, Fort Ord, Calif.
81. 81st Ordnance Company (HM—Tanks)	GHQ	Fort Bliss, Tex.
82. 82nd Ordnance Company (HM—Field Army)	13th Ordnance Battalion (Maintenance & Supply), Fourth Army	Fort Ord, Calif.
83. 83rd Ordnance Company (HM—Tanks)	GHQ	Fort Lewis, Wash.
84. 84th Ordnance Company (Depot)	11th Ordnance Battalion (Maintenance & Supply), Second Army	Erie Ordnance Depot, Ohio
85. 85th Ordnance Company (HM—Tanks)	GHQ	Camp Bowie, Tex.
95. 95th Ordnance Company (Maintenance—Railway Artillery)	GHQ	Fort Hancock, N. J.
96. 96th Ordnance Company (Maintenance—Railway Artillery)	GHQ	Aberdeen Proving Ground, Md.
101. 101st Ordnance Company (MM)	6th Ordnance Battalion (Maintenance), VI Corps (First Army)	Camp Edwards, Mass.
102. 102nd Ordnance Company (MM)	7th Ordnance Battalion (Maintenance), VII Corps (Second Army)	Fort McClellan, Ala.
103. 103rd Ordnance Company (MM)	2nd Ordnance Battalion (Maintenance), II Corps (First Army)	Indiantown Gap, Pa.
104. 104th Ordnance Company (MM)	2nd Ordnance Battalion (Maintenance), II Corps (First Army)	Fort George G. Meade, Md.
105. 105th Ordnance Company (MM)	1st Ordnance Battalion (Maintenance), I Corps (First Army)	Fort Jackson, S. C.
106. 106th Ordnance Company (MM)	4th Ordnance Battalion (Maintenance), IV Corps (Third Army)	Camp Blanding, Fla.
107. 107th Ordnance Company (MM)	GHQ	Camp Livingston, La.
108. 108th Ordnance Company (MM)	7th Ordnance Battalion (Maintenance), VII Corps (Second Army)	Camp Forrest, Tenn.
109. 109th Ordnance Company (MM)	5th Ordnance Battalion (Maintenance), V Corps (Third Army)	Camp Claiborne, La.
110. 110th Ordnance Company (MM)	7th Ordnance Battalion (Maintenance), VII Corps (Second Army)	Camp Robinson, Ark.
111. 111th Ordnance Company (MM)	8th Ordnance Battalion (Maintenance), VIII Corps (Third Army)	Camp Bowie, Tex.
112. 112th Ordnance Company (MM)	5th Ordnance Battalion (Maintenance), V Corps (Third Army)	Camp Shelby, Miss.
113. 113th Ordnance Company (MM)	5th Ordnance Battalion (Maintenance), V Corps (Third Army)	Camp Shelby, Miss.
115. 115th Ordnance Company (MM)	3rd Ordnance Battalion (Maintenance), III Corps (Fourth Army)	Camp San Luis Obispo, Calif.
116. 116th Ordnance Company (MM)	9th Ordnance Battalion (Maintenance), IX Corps (Fourth Army)	Fort Lewis, Wash.
118. 118th Ordnance Company (MM)	4th Ordnance Battalion (Maintenance), IV Corps (Third Army)	Camp Blanding, Fla.
119. 119th Ordnance Company (MM)	2nd Ordnance Battalion (Maintenance), II Corps (First Army)	Fort Dix, N. J.
120. 120th Ordnance Company (MM)	8th Ordnance Battalion (Maintenance), VIII Corps (Third Army)	Camp Barkley, Tex.
440. 440th Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Albuquerque, N. Mex.
441. 441st Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Bangor, Me.
442. 442nd Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Boise, Idaho
443. 443rd Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Bowman Field, Louisville, Ky.
444. 444th Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Fresno, Calif.
445. 445th Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Jackson, Miss.
446. 446th Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Langley Field, Va.
447. 447th Ordnance Company (Avn.—Bombardment)	GHQ Air Force	MacDill Field, Fla.
448. 448th Ordnance Company (Avn.—Bombardment)	GHQ Air Force	McChord Field, Wash.
449. 449th Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Manchester, N. H.
450. 450th Ordnance Company (Avn.—Bombardment)	GHQ Air Force	New Orleans, La.
451. 451st Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Oklahoma City, Okla.
452. 452nd Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Orlando, Fla.
453. 453rd Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Salt Lake City, Utah
454. 454th Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Savannah, Ga.
455. 455th Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Sunset Field, Spokane, Wash.

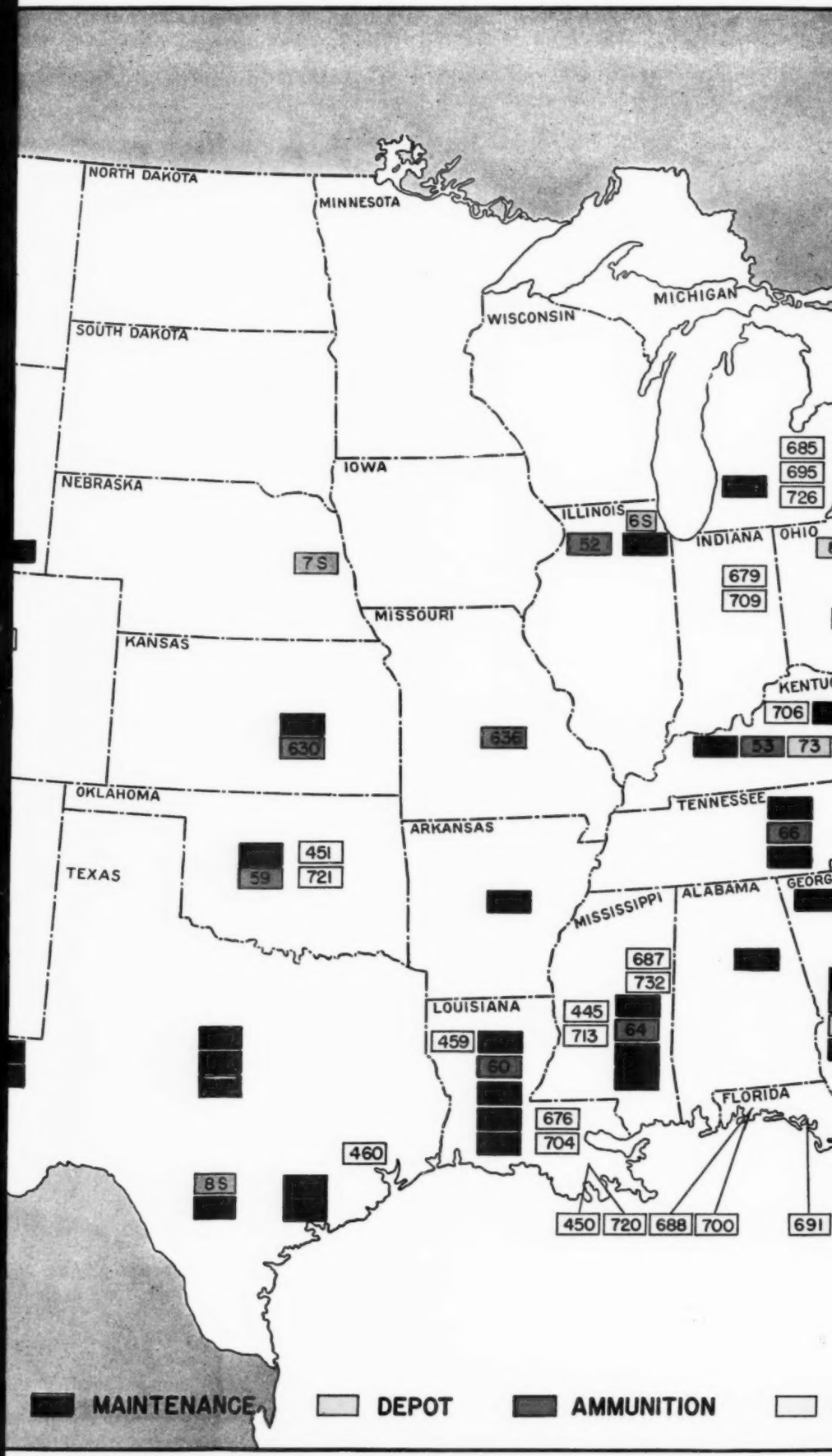
Ordnance Field Service in the A

Explanatory Data with Reference to Each Military Unit Are Given



dnance Field Service in the Army of the United States

ference to Each Military Unit Are Given under the Corresponding Numbers on Pag



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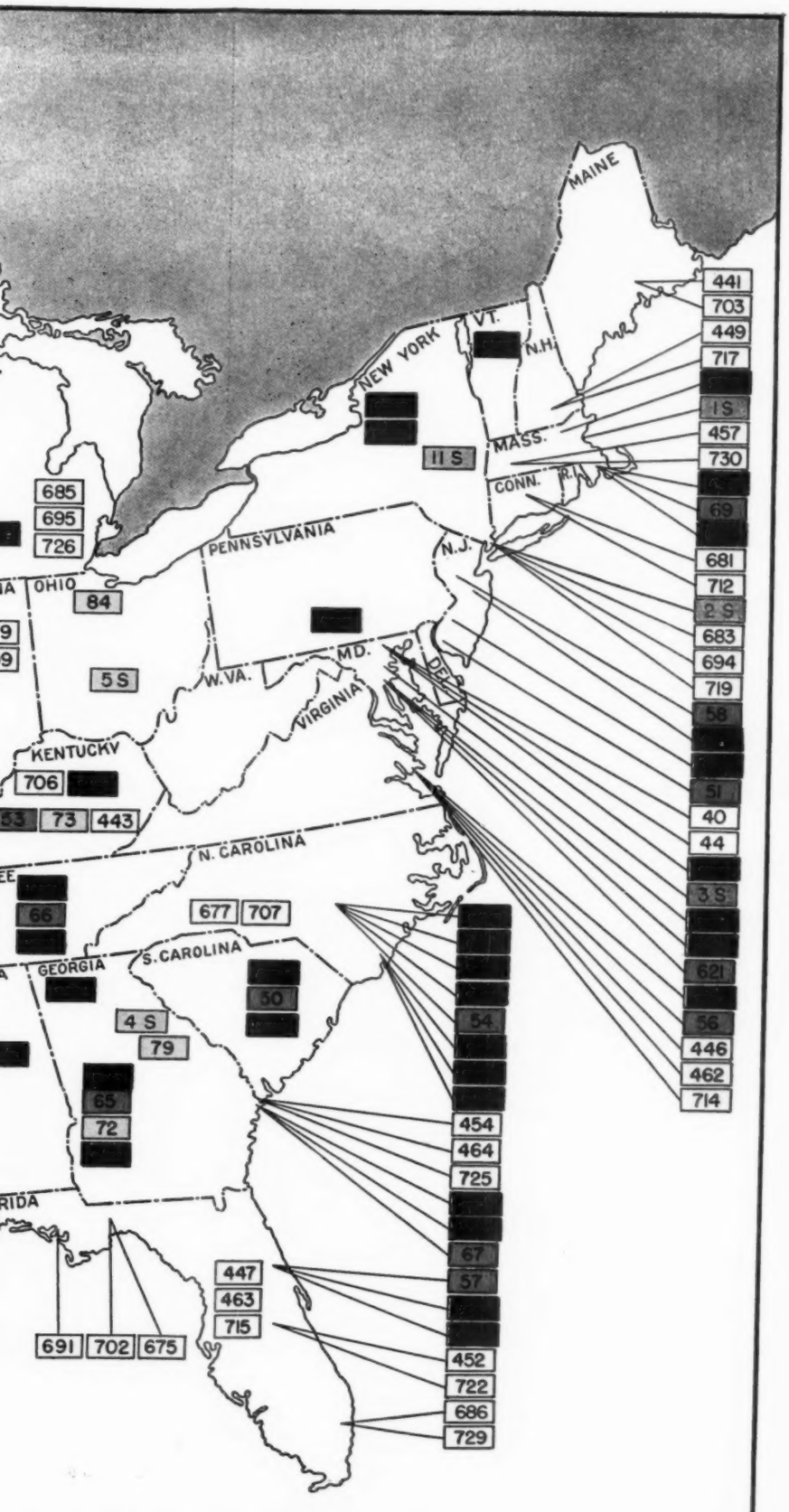

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Organization	Assignment	Station
456. 456th Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Tucson, Ariz.
457. 457th Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Westover Field, Mass.
458. 458th Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Pendleton, Oreg.
459. 459th Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Barksdale Field, La.
460. 460th Ordnance Company (Avn.—Bombardment)	Air Corps School	Ellington Field, Tex.
461. 461st Ordnance Company (Avn.—Bombardment)	Air Corps School	Lowry Field, Colo.
462. 462nd Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Langley Field, Va.
463. 463rd Ordnance Company (Avn.—Bombardment)	GHQ Air Force	MacDill Field, Fla.
464. 464th Ordnance Company (Avn.—Bombardment)	GHQ Air Force	Savannah, Ga.
481. 481st Ordnance Company (Avn.—Bombardment)	Hawaiian Department	Hickam Field, T. H.
482. 482nd Ordnance Company (Avn.—Bombardment)	Hawaiian Department	Hickam Field, T. H.
483. 483rd Ordnance Company (Avn.—Bombardment)	Panama Canal Department	Howard Field, C. Z.
484. 484th Ordnance Company (Avn.—Bombardment)	Puerto Rican Department	Borinquen Field, P. R.
485. 485th Ordnance Company (Avn.—Bombardment)	Puerto Rican Department	Borinquen Field, P. R.
621. 621st Ordnance Company (Am)	24th Ordnance Battalion (Ammunition), First Army	Fort George G. Meade, Md.
630. 630th Ordnance Company (Am)	25th Ordnance Battalion (Ammunition), Second Army	Fort Riley, Kans.
632. 632nd Ordnance Company (Am)	23rd Ordnance Battalion (Ammunition), Fourth Army	Fort Ord, Calif.
636. 636th Ordnance Company (Am)	25th Ordnance Battalion (Ammunition), Second Army	Fort Leonard Wood, Mo.
673. 673rd Ordnance Company (Avn.—Pursuit)	Puerto Rican Department	Ponce Field, P. R.
674. 674th Ordnance Company (Avn.—Pursuit)	Hawaiian Department	Wheeler Field, T. H.
675. 675th Ordnance Company (Avn.—Pursuit)	GHQ Air Force	Tallahassee, Fla.
676. 676th Ordnance Company (Avn.—Pursuit)	GHQ Air Force	Baton Rouge, La.
677. 677th Ordnance Company (Avn.—Pursuit)	GHQ Air Force	Charlotte, N. C.
678. 678th Ordnance Company (Avn.—Pursuit)	GHQ Air Force	Everett, Wash.
679. 679th Ordnance Company (Avn.—Pursuit)	GHQ Air Force	Fort Wayne, Ind.
680. 680th Ordnance Company (Avn.—Pursuit)	GHQ Air Force	Hamilton Field, Calif.
681. 681st Ordnance Company (Avn.—Pursuit)	GHQ Air Force	Windsor Locks, Conn.
682. 682nd Ordnance Company (Avn.—Pursuit)	GHQ Air Force	March Field, Calif.
683. 683rd Ordnance Company (Avn.—Pursuit)	GHQ Air Force	Mitchel Field, N. Y.
684. 684th Ordnance Company (Avn.—Pursuit)	GHQ Air Force	Portland, Oreg.
685. 685th Ordnance Company (Avn.—Pursuit)	GHQ Air Force	Selfridge Field, Mich.
686. 686th Ordnance Company (Avn.—Pursuit)	GHQ Air Force	West Palm Beach, Fla.
687. 687th Ordnance Company (Avn.—Pursuit)	GHQ Air Force	Meridian, Miss.
688. 688th Ordnance Company (Avn.—Pursuit)	Air Corps School	Eglin Field, Valparaiso, Fla.
690. 690th Ordnance Company (Avn.—Pursuit)	Air Corps School	Las Vegas, Nev.
691. 691st Ordnance Company (Avn.—Pursuit)	Air Corps School	Panama City, Fla.
692. 692nd Ordnance Company (Avn.—Pursuit)	GHQ Air Force	Hamilton Field, Calif.
693. 693rd Ordnance Company (Avn.—Pursuit)	GHQ Air Force	March Field, Calif.
694. 694th Ordnance Company (Avn.—Pursuit)	GHQ Air Force	Mitchel Field, N. Y.
695. 695th Ordnance Company (Avn.—Pursuit)	GHQ Air Force	Selfridge Field, Mich.
696. 696th Ordnance Company (Avn.—Pursuit)	Hawaiian Department	Wheeler Field, T. H.
697. 697th Ordnance Company (Avn.—Pursuit)	Panama Canal Department	Albrook and France Fields, C. Z.
698. 698th Ordnance Company (Avn.—Composite)	Philippine Department	Nichols and Clark Fields, P. I.

The Army's System of Armament Maintenance and Supply

Organization	Assignment	Station
699. 699th Ordnance Company (Avn.—Composite)	Alaska	Anchorage and Fairbanks, Alaska
700. 700th Ordnance Company (Avn.—Composite)	Air Corps School	Eglin Field, Valparaiso, Fla.
701. 701st Ordnance Company (Avn.—Air Base)	GHQ Air Force	Albuquerque, N. Mex.
702. 702nd Ordnance Company (Avn.—Air Base)	GHQ Air Force	Tallahassee, Fla.
703. 703rd Ordnance Company (Avn.—Air Base)	GHQ Air Force	Bangor, Me.
704. 704th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Baton Rouge, La.
705. 705th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Boise, Idaho
706. 706th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Bowman Field, Louisville, Ky.
707. 707th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Charlotte, N. C.
708. 708th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Everett, Wash.
709. 709th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Fort Wayne, Ind.
710. 710th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Fresno, Calif.
711. 711th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Hamilton Field, Calif.
712. 712th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Windsor Locks, Conn.
713. 713th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Jackson, Miss.
714. 714th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Langley Field, Va.
715. 715th Ordnance Company (Avn.—Air Base)	GHQ Air Force	MacDill Field, Fla.
716. 716th Ordnance Company (Avn.—Air Base)	GHQ Air Force	McChord Field, Wash.
717. 717th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Manchester, N. H.
718. 718th Ordnance Company (Avn.—Air Base)	GHQ Air Force	March Field, Calif.
719. 719th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Mitchel Field, N. Y.
720. 720th Ordnance Company (Avn.—Air Base)	GHQ Air Force	New Orleans, La.
721. 721st Ordnance Company (Avn.—Air Base)	GHQ Air Force	Oklahoma City, Okla.
722. 722nd Ordnance Company (Avn.—Air Base)	GHQ Air Force	Orlando, Fla.
723. 723rd Ordnance Company (Avn.—Air Base)	GHQ Air Force	Portland, Oreg.
724. 724th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Salt Lake City, Utah
725. 725th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Savannah, Ga.
726. 726th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Selfridge Field, Mich.
727. 727th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Sunset Field, Spokane, Wash.
728. 728th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Tucson, Ariz.
729. 729th Ordnance Company (Avn.—Air Base)	GHQ Air Force	West Palm Beach, Fla.
730. 730th Ordnance Company (Avn.—Air Base)	GHQ Air Force	Westover Field, Mass.
731. 731st Ordnance Company (Avn.—Air Base)	GHQ Air Force	Pendleton, Oreg.
732. 732nd Ordnance Company (Avn.—Air Base)	GHQ Air Force	Meridian, Miss.
740. 740th Ordnance Company (Avn.—Air Base)	Hawaiian Department	Hickam Field, T. H.
741. 741st Ordnance Company (Avn.—Air Base)	Hawaiian Department	Wheeler Field, T. H.
742. 742nd Ordnance Company (Avn.—Air Base)	Panama Canal Department	Albrook Field, C. Z.
743. 743rd Ordnance Company (Avn.—Air Base)	Panama Canal Department	France Field, C. Z.
744. 744th Ordnance Company (Avn.—Air Base)	Panama Canal Department	Howard Field, C. Z.
745. 745th Ordnance Company (Avn.—Air Base)	Philippine Department	Nichols Field, P. I.
746. 746th Ordnance Company (Avn.—Air Base)	Puerto Rican Department	Borinquen Field, P. R.
747. 747th Ordnance Company (Avn.—Air Base)	Puerto Rican Department	Ponce Field, P. R.
748. 748th Ordnance Company (Avn.)	Alaska	Elmendorf Field, Anchorage, Alaska

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MAY-JUNE, 1941

Month by Month

A BROAD SURVEY OF THE PRESENT STATUS OF our armament program at this stage groups itself into three main divisions: (1) the constantly increasing size of the undertaking; (2) the unfortunate delays caused by strikes on defense work; (3) the notable advances, particularly in ordnance production and military organization, which are being made. These three topics furnish ground for the following comment:

Authorized and proposed Government expenditures for defense total $39,177,800,000, according to a compilation issued on March 26th by the Office of Production Management. This includes the $7,000,000,000 to be spent under H.R. 1776 for aid to Great Britain and other countries. If British orders of $3,511,000,000 placed in this country for war equipment and supplies are added, direct defense expenditures for United States and British account, authorized and proposed, amount to $42,688,800,000.

Expenditures against these sums made by the United States Treasury from June 1, 1940, through March 17, 1941, totaled $3,452,000,000. This includes expenditures of the Navy, payments from the President's defense fund, the cost of administering the Selective Service law, and military expenditures of the War Department, but does not include expenditures upon the Panama Canal or rivers and harbors.

Of the $40,000,000,000 in the United States Government defense program, $29,912,600,000 has been covered by appropriations and contract authorizations already made, and $9,265,200,000 has been proposed in the 1942 budget and bills now before Congress.

A breakdown of these figures is given in the following table prepared by the Bureau of Research and Statistics, Office of Production Management (amounts are in millions of dollars):

Fiscal Year 1941 Appropriation Acts:	
War Department	$ 9,238.3
Navy Department	10,966.0
Other U.S. agencies	961.3
Loan Agreements:	
RFC facilities and stockpile	1,175.7
Export-Import Bank	500.0
Other defense agencies	71.3
Lease-Lend Act:	7,000.0
Total authorized U.S. program	$29,912.6
Proposed Additional Fiscal Year 1941 and Fiscal Year 1942 Bills Now Before Congress (Preliminary):	
War Department	3,617.1
Navy Department	1,346.6
Other U.S. agencies	1,219.4
Fiscal Year 1942 Estimates Submitted to Congress:	
War Department	2,931.4
Other U.S. agencies	150.7
Total pending U.S. program	$ 9,265.2
Total authorized and pending U.S. program	39,177.8
British orders in U.S.	3,511.0
U.S. program plus British orders	$42,688.8

Analysis of the foregoing figures given under items "other U. S. agencies" and "defense loans" reveals the extent to which other branches of the Government than the Army and Navy are participating in the national-defense program or are expected to participate. This compilation lumps existing and proposed appropriations and authorizations. It shows that construction of vessels for the merchant fleet, building of industrial facilities, and erection of new housing are the principal fields in which other departments are assisting the military and naval authorities in defense preparation. The breakdown (in millions of dollars) follows:

Object	*Amount*
Merchant fleet	$ 638
Industrial facilities:	
RFC and DPC loans	599
Maritime Commission	36
Industrial working capital (RFC loans)	151
Stockpile:	
Treasury	60
RFC	425
Housing (FWA, USHA, DHC, etc.)	621
Export-Import Bank	500
President's emergency fund	325
Panama Canal	251
Defense training program (NYA, FSA)	110
Civil Aëronautics Authority (and Department of Commerce)	94
Tennessee Valley Authority	55
Marine insurance	40
Selective Service	34
Coast Guard	27
National Defense Council and OPM	20
All other	92
Total	$4,078

During recent weeks there has been a rapid increase in Treasury payments in the national-defense program. The daily statement of the Treasury shows that payments for the month of March, through March 17th, amounted to $403,000,000, compared with $592,000,000 for all of February and $572,000,000 for January.

Monthly payments beginning with June 1940 have been as follows (in millions of dollars): June, 153; July, 177; August, 200; September, 219; October, 287; November, 376; December, 473; January 1941, 572; February, 592; and March, through the 17th, 403. The total for 9½ months is $3,452,000,000.

Treasury payments lag several weeks behind deliveries; hence, although the figures in the foregoing tabulation reflect accelerated deliveries, they do not indicate deliveries made in designated months. Goods—not dollars—prove production.

On the labor front, the situation is indeed disquieting, for the entire defense program is put in a decidedly paradoxical situation. On the one hand, management is speeding production by every means; on the other, bitter strife by and between labor organizations is permitted to delay production. Ways and means must be found and found quickly to bring disloyal and discordant elements to book. The National Defense Mediation Board, established late in March, has approached the problem with fairness and dispatch, but, at this writing, violence and bloodshed characterize several particularly serious strikes and there seems to be little hope of early solution short of a firm stand by Government.

Recriminations will not remedy present evils. Government should not forbid strikes; neither should it encourage them. Legislation now on the statute books certainly does encourage strikes, or at least this legislation is top-heavy in favor of labor as against management. As the *New York Times* said editorially, "If employers are to be prohibited from coercing workers against joining a union, union members should be equally prohibited from coercing workers into joining a union. If unions are to be encouraged and sponsored by Government, then Government should prohibit extortionate initiation fees and exorbitant dues. If corporations must have full publicity for their finances, unions should likewise be forced to make their finances public. This is the only way in which union members can systematically check unreasonable official salaries, racketeering, and exploitation of individual members."

The present wave of strikes is doing untold damage to the defense program, not only in man-hours lost but especially in the loss of morale which is so essential to success. While we look upon a defeated France as an object lesson of what a modern army should not be, we err grievously if we underestimate or forget the part Communistic strikes played in the collapse of that country. We are not immune from the Red menace!

Probably the best analysis of the great strides made in ordnance production was given by the Under Secretary of War, Hon. Robert P. Patterson, in an address before the West Point Society of New York on March 15th. He said:

"Let me recite to you some figures which have just been assembled by the Ordnance Department. Our arsenals are as much a part of the Army as the Military Academy itself. Inevitably they are carrying only a small portion of the defense load, for they have never been geared to a program of the dimensions of our present effort. But they are doing a fine job. Listen to these comparisons:

"Two years ago, our Army arsenals were employing 13,000 workers; today's figure is 35,000. In 1939, our Army arsenals produced an average of 7,500,000 rounds of small-arms ammunition a month; the 1941 average is 38,000,000 rounds a month. In 1939, the arsenals were turning out 43,500 artillery cartridge cases a month; this year the figure is 560,000. Small-arms spare parts have increased from 40,000 a month to 373,000 a month; the fire-control instrument output from 38 to 330. In artillery shells, the increase has been from 13,900 to 406,000. And listen to this one: Two years ago we were manufacturing 912 Garand semiautomatic rifles a month. Today, we are turning them out at the rate of 15,000 a month.

"Private industry is doing the major part of the job, and it is doing it splendidly. There have been delays, there have been heartaches, there have been headaches. But they have been nothing in comparison with the progress that has been recorded and which will be recorded from this time on with accelerating momentum.

"You know—none better—that this job cannot be done overnight. It took four years to make each one of you a second lieutenant. You cannot make a fieldpiece by pushing a button, or a tank by dropping a coin in a slot, no matter how big the coin may be. It takes brains, time, planning, money.

"I have said a good deal about munitions, but, aside from a few bare statistics, nothing about men. Put them together and you have started to build an army. But you have only started; an essential ingredient remains to be added—training. You have been through the mill, and you know what training did for you—what it made of you. You may be sure that training is receiving the importance it deserves in this present program. We have new men, we have new weapons, but while we have abolished 'squads right,' we still have basically the same training system—the good old-time religion of the Army. It is working. It is turning out soldiers that we shall be proud of, soldiers that we are already proud of, and who are proud of themselves."

"Arsenal of Democracy" is the title of a new and most timely book from the pen of Burnham Finney, editor of the *American Machinist*. This volume should be read and studied by all executives and engineers who want an authentic and current statement of our armament progress in all its phases. The author is exceptionally well qualified for his task. The following quotation apropos of the Industrial Mobilization Plan indicates the caliber of Mr. Finney's thinking and the strength of his expression. In his remarks here, as in countless other places throughout the book, he is, of course, one hundred per cent correct.

"Are we farther along today . . . than if we hadn't the industrial-mobilization scheme in operation for many years? The unqualified answer is, 'Yes, we are farther along.' Proof? The Army and Navy knew *what* they wanted when the present emergency began. That, in the opinion of expert military men, is the outstanding difference between 1917 and today. The thousands of plants surveyed are now starting to make the products allocated to them under the plan. . . . Precious time has been saved; perhaps not enough of it, but some. Altogether, the efforts quietly exerted by the Army and Navy during the years when war seemed remote have paid dividends."

And while on the subject of timely books, we urge all readers of Army Ordnance to familiarize themselves with "Armament Production Policies" (as announced on page 654 of this issue). This is a record of a forum held by the New York Post of the Army Ordnance Association and contains a verbatim transcript of the questions and answers on various phases of the policy and procedure connected with armament production. Thanks to the foresight of Brig. Gen. Samuel McRoberts, chief of the New York Ordnance District and president of the New York Post, and to the fine coöperation of James R. White who conducted the forum, this permanent record of timely information is made available to all members of the Association and the public.

Priorities

An Editorial

FIRST things ought to come first always. They *must* come first in time of war or when war is imminent or in time of grave national emergency. Insistence upon such orderliness and the procedure for it we know as priorities. It is the name given to the system and the organization which determine the order of preference and decide which things come ahead of others. In that they interfere with free choice and put the general welfare ahead of the individual preference, priorities have been called, quite correctly, the iron hand in the velvet glove.

To prepare for modern defense on the scale at which the United States is now preparing would be quite impossible without priorities. Hence the action by the President on March 8, 1941, when he established the Division of Priorities in the Office of Production Management, was the longest step yet taken toward an orderly procedure in our current industrial mobilization. Of all the other new steps in this direction, none is on a par with Regulation No. 3 of the above date, which put priorities in motion.

It is interesting, and indeed essential, that there be a clear understanding of just what the priorities principle involves. As now established, the powers of the priority commissioner are broad yet specific; the procedure is accurately defined, yet elastic. The personnel, operating under the Office of Production Management and in coöperation with the Army and Navy Munitions Board, is under the direction of Edward R. Stettinius, Jr., who is familiar with the principles of industrial mobilization due to his long and intimate association with the Industrial Mobilization Plan.

The Director of Priorities, in order that he may effectuate and carry out the authorities, duties, and responsibilities assigned him, has been given the following specific authorizations. He is empowered: (1) To establish such organization as he may deem necessary to the adequate execution of the functions with which he is charged; (2) To provide for the assignment of preference ratings to all contracts and subcontracts and materials directly or indirectly necessary to the defense program—on ultimate military items he is guided by categories of military preference as set forth from time to time by the Army and Navy Munitions Board; (3) To issue priority certificates on orders to contractors, subcontractors, and others supplying material directly or indirectly necessary to the defense program; (4) To utilize and supervise, in accordance with procedures devised with the concurrence of the Army and Navy Munitions Board, the services of the contracting and procurement officers and inspectors of the War and Navy Departments in connection with priorities and related matters; (5) To establish preferences with respect to indirect defense material and domestic and foreign material pursuant to such agreement and coöperation as may be necessary; (6) To make allocations, establish procedures, and generally to take all steps necessary to bring about prompt delivery of direct and indirect defense material.

March 8, 1941, thus marks the beginning of an emergency economy for industry in the United States. It will be a happy circumstance if all elements of industry—labor as well as management—understand at once the broad powers and implications of the priorities system.

Past experience points many a guide for the public reaction to the hardships which a priorities system is bound to bring. Experience also points the way to sensible public reaction. To recall one such experience may prove the point. The War Industries Board of 1918, in its famous Circular No. 21, established priorities for the building-construction industry. There was considerable adverse comment; inasmuch as it did not exempt churches from the list of nonwar construction, the board was accused of godlessness! It devolved upon the then-popular Rev. William A. Sunday, who was adversely affected by the order (it forbade him to build the well-known tabernacles in which he held his meetings) to rally his forces in support of priorities. A letter which he wrote to Judge Edwin B. Parker upholding the priorities restriction became a model of those days. It was widely publicized and was of genuine assistance to the board and to the priorities commissioner.

IT remains to be seen how readily our peace-time economy will acquiesce to emergency restrictions. But if production for defense be the one great need of the hour—as is so widely and loudly claimed on all sides—then industrial priorities should not be repugnant to any of our citizens. But if our demand for armament production is simply a matter of talk, then priorities will have many hard and annoying conflicts with peaceful procedure. Priorities are the test of our sincerity about national defense because priorities are the first challenge to individual convenience. Not only that, but the priorities system is a challenge to the industrial leaders who have been called to serve in the super-organization for defense. Here, in the application of priorities, is the real usefulness of civilian—in contradistinction to military—leadership. In truth there has been much wasted time and energy on the part of many well-intentioned people who have tried to assist the defense program. Civilian Americans, who bother very little about national defense, are usually quite remote from military Americans who take the thing seriously—even when all the world sees through rose-colored glasses. Until very recently the former outnumbered the latter a thousand to one. But the operation of priorities—being a civil obligation—is particularly the duty of civilian leaders. The military can very well classify the order of importance of the components of our daily necessities, but the execution of that order is essentially a test of the good judgment and acumen and industrial experience—not of soldiers but of civilians.

But the fog of super-organization is dispelled by the establishment of the priorities system. The Army and Navy of the United States have especial need of a coördinate civilian body which can control in civilian fields wherein the Army and Navy have little or no warrant. The establishment of priorities is far and away the most important step thus far taken in our organization of the nation as a whole for its defense responsibilities. Our people, if they take kindly to priorities, will themselves be rendering a service of first importance to the national defense. If the hardships of priorities create discontent, or even opposition, then we are not serious about our armament job. Whether all our talk about the "arsenal of democracy" is true or false depends, at this stage of things, on the success or failure of priorities. L. A. C.

Association Affairs

Directors' Meeting

THE twenty-second annual meeting of the trustees and directors of the Army Ordnance Association was held at the Metropolitan Club, New York City, on February 14, 1941. The meeting was called to order at 2 o'clock in the afternoon by Brig. Gen. Benedict Crowell, president of the Association, who presided. The following officers and directors were present: Col. William W. Coleman, vice-president; Col. Frederick H. Payne, vice-president; Maj. Gen. William Crozier, director; Col. Robert P. Lamont, director; Brig. Gen. Samuel McRoberts, director; Col. James L. Walsh, director; Col. Charles H. Tenney, director; George W. Elliott, director; Brig. Gen. John Ross Delafield, counsel; Brig. Gen. Chas. Elliot Warren, treasurer, and Lieut. Col. L. A. Codd, Ord. Res., executive vice-president and secretary.

The president extended special greetings to General Crozier, former Chief of Ordnance, a member of the board representing the Washington Post, and also to Mr. Elliott, a member of the board representing the Philadelphia Post. The president also announced the election to the board of J. B. Doan, representing the Cincinnati Post.

The first business to come before the meeting was the report of the treasurer for the year 1940. General Warren submitted a detailed verbal report analyzing the financial operations of the Association for the calendar year. Gross receipts were $73,644.44; gross expenditures were $60,505.69. The excess of operating receipts over operating disbursements was $13,138.75. Cash on hand as of December 31, 1940, was $16,219.41; securities owned as of that date had a market value of $24,901.25. The balance sheet disclosed an operating reserve of $11,798.73.

Detailed receipts and expenditures, with comparative totals for the preceding year, were as follows:

RECEIPTS AND EXPENDITURES

Receipts	*1940*	*1939*
Old members	$20,040.03	$12,914.30
New members	20,306.05	8,951.52
Interest	1,014.27	1,078.75
Subscribers	3,823.19	2,813.52
Advertising	14,968.68	8,606.17
Annual Meeting	12,205.00	6,005.13
Miscellaneous	1,287.22	514.76
Life members	0.00	100.00
Total	$73,644.44	$40,984.15
Expenditures	*1940*	*1939*
Rent	$ 1,642.50	$ 1,309.50
Office expense	3,672.55	2,338.76
Salaries	14,445.76	12,901.68
Postage	1,495.38	1,270.52
Annual Meeting	12,022.44	6,538.94
Office equipment	2,092.05	389.45
Extension	1,342.12	1,455.51
Post refunds	2,417.80	936.47
Contingencies	1,280.72	945.53
Army Ordnance	18,979.41	11,549.34
Taxes and insurance	57.22	51.24
Bulletin	1,057.74	0.00
Transfer to investment acct	0.00	29.38
Total	$60,505.69	$39,716.32

The treasurer announced that the annual audit of the financial records of the Association had been made by Ernst & Ernst, certified public accountants, as of December 31, 1940. Copies of the audit report were available at the meeting. The treasurer's report was received with thanks. A motion was unanimously adopted thanking General Warren for his services to the Association as treasurer since its foundation in 1919.

The next order of buiness was the annual report of the executive vice-president and secretary. Excerpts from the report follow:

The total membership of the Association in good standing as of January 1, 1940, was 4,683. During the year, 2,999 new members were enrolled while 390 old members were removed from the roster through resignation, death, and nonpayment of dues. The membership December 31, 1940 was 6,594.

During the year, the Cleveland Post was established with a membership of 582. The inaugural meeting of the Post was held at a banquet October 25, 1940, at the Hotel Cleveland. The charter was presented by the president of the Association and the principal address was made by Maj. Gen. C. M. Wesson, Chief of Ordnance. There are now sixteen chartered posts.

During the year, a policy was inaugurated of assigning all members to the local Post in which area they reside. Heretofore, this policy applied only to new members; now the entire membership of the Association is affiliated with local posts except in those areas where no local post exists. The confines of local posts are generally the same as those of the several Ordnance districts.

The following budget of income estimated for the year 1941 is based in general upon a conservative analysis of receipts for 1940 and the expectation of sustained interest in Ordnance and national-defense questions. The budget of expenditures provides for increased activities.

Receipts		*Expenditures*	
Old members	$37,400	Office rent	$ 2,300
New members	11,000	Office expense	4,000
Magazine subscriptions, renewal	2,000	Salaries	19,000
Magazine subscriptions, new	1,600	Postage	2,000
Advertising	20,000	Annual Meeting	2,000
Interest	1,000	Office equipment	1,000
		Post refunds	3,000
		Contingencies	4,000
		Membership extension	2,000
		Army Ordnance	27,200
		Bulletin	5,000
Total	$73,000	Total	$71,500

Throughout the year many local and regional meetings were held under the auspices of the various local Posts individually and in conjunction with engineering and industrial societies. Officers of the Ordnance Department, particularly the Chief of Ordnance, addressed many of these gatherings. Following the practice of recent years, the executive secretary accepted, wherever possible, invitations to address national-defense meetings throughout the country. These included technical and engineering societies, military organizations, schools, and colleges, from Massachusetts to California and in Canada. In frequency they averaged about three a month. Such of these gatherings as were under the auspices of the Army Ordnance Association were fully described in Army Ordnance during the year.

Special acknowledgment is made to the officers and directors of the new Cleveland Post which was established October 25, 1940. This was the largest inaugural meeting of any of the sixteen local chapters and particular thanks are tendered to Maj. H. M. Reedall whose initiative and energy were largely responsible for the undertaking.

It will be noted from the budget of expenditures submitted for 1941 that constant effort is proposed for building the Association's strength to at least 10,000 members. To this end, all the energies of the organization are to be put both nationally and locally. Local Posts will be asked to aid in the endeavor by using their organizations to stimulate a broader knowledge of ordnance achievement.

Coincidentally, the Association should embark upon a broader field of service through its publications, local chapters, and special committees to assist the national defense in every possible way. This program will be placed before local Post officials in the near future so that the Association can be of maximum service to the Ordnance Department.

Special acknowledgment is made to all officers and directors whose helpful interest during the past year has con-

tributed so largely to the Association's success. In the same spirit, grateful acknowledgment is made to the Chief of Ordnance and to his entire organization for unfailing coöperation in the attainment of the Association's objectives.

The year 1940 was, for the Army Ordnance Association, a period of vindication and achievement. Having proved the soundness of the principles for which it has stood from its beginning, it is now incumbent upon the organization to amass greater strength in every field—membership, financial, and service—in order that it may assist in the current national-defense effort with maximum effect. When the present defense effort shall have been completed successfully, the obligation to carry on the principles of industrial preparedness as a permanent part of our national economy must be borne by the Association as surely and as effectively in the future as that obligation has been met by the Association in the past.

The balance sheet of the Association, as of December 31, 1940, was as follows:

Assets	*1940*	*1939*
Cash on hand	$ 20.00	$ 20.00
Cash on deposit	16,219.41	3,080.66
Accounts receivable:		
Due from advertisers	192.63	483.73
Other assets:		
Securities owned	24,557.82	24,557.82
Postage	271.04	122.75
Furniture and fixtures	1.00	1.00
Deferred charges:		
Commission on prepaid advertising	72.00	144.90
Total	$41,333.90	$28,410.86

Liabilities	*1940*	*1939*
Unearned income:		
Prepaid membership dues	$24,785.92	$11,152.55
Prepaid subscriptions to magazine	1,401.75	774.75
Prepaid advertising	175.00	352.00
Salary payable	250.00	0.00
Reserves:		
Endowment fund	822.50	822.50
Life memberships	2,100.00	2,100.00
Operating reserve	11,798.73	13,209.06
Total	$41,333.90	$28,410.86

Among the projects approved by the board was the foundation of three medals to be awarded for distinguished ordnance service, to bear the names of three distinguished leaders. Further announcement of these medals appears on page 620.

UNIVERSITY OF MICHIGAN

A NEW local Post of the Army Ordnance Association—the seventeenth—was inaugurated at University of Michigan, Ann Arbor, Mich., February 20, 1941. Nearly 200 members of the Association were present to hear an address by Brig. Gen. G. M. Barnes, assistant chief, Industrial Service, Ordnance Department, and a distinguished alumnus of Michigan. Hon. Walter C. Sadler, mayor of Ann Arbor and professor of civil engineering at Michigan, presided. The charter of the new Post was presented on behalf of the president of the Association by Lieut. Col. L. A. Codd, executive vice-president.

Those at the speakers' table, in addition to General Barnes, Mayor Sadler and Colonel Codd, were: Col. Francis M. Brannan, in charge of the Department of Military Science and Tactics, University of Michigan; Col. Henry W. Miller, head of the Department of Engineering Drawing; Alfred H. Lovell, assistant dean of engineering and professor of electrical engineering; Joseph A. Bursley, dean of men and professor of mechanical engineering, and Capt. W. E. Renner, in charge of the Ordnance Unit at the university.

General Barnes spoke on "Ordnance Engineering." He said in part:

"I feel very much honored in being privileged to take part in these ceremonies which have marked the establishment of a Post of the Army Ordnance Association at the University of Michigan. In the first place, this occasion has given me the opportunity to visit Ann Arbor again and to note the growth and prosperity of our university; and, in the second place, I have been connected either directly or indirectly with the Army Ordnance Association since it was established in 1919. The objective of the Association is our national defense, and in this work the Association has based its activities upon those of the Ordnance Department of the United States Army—the organization in which I have spent the active years of my life since leaving the university. The Army Ordnance Association chapter here at Ann Arbor will therefore always have a special significance to me.

"About a month ago, the Chief of Ordnance was able to report to the Secretary of War that in six weeks following the day in last September when funds were made available by Congress, his Department had been able to place with industry two billion dollars' worth of orders for munitions. In my opinion, no other business organization in the United States, or for that matter, in the world, could have placed orders of this magnitude in such a short time. To understand how this task was accomplished it is necessary to review very briefly what has taken place in this connection since the World War of 1917-1918.

"At the conclusion of that war, leaders of the Ordnance Department and industrial leaders of the country were of the opinion that in another emergency it would be possible to save a great deal of time in going into production of munitions. Time could be saved through the elimination of the difficulties which were encountered in the last war. It was conceded that if the United States were to be able to produce munitions quickly in another emergency, it would be necessary to maintain in time of peace close coöperation between the Ordnance Department of the War Department on the one hand and American industry on the other. The problem was to find a means of maintaining this interest in peace time when no funds were available for this purpose. It was with this thought that the Army Ordnance Association was brought into being.

"This organization has worked tirelessly throughout the past twenty-two years on its task of promoting coöperation between American industry and the War Department. To this end it has established Posts throughout the United States. There have been frequent meetings of these various Posts in the great industrial centers of the United States as well as annual meetings usually held at Aberdeen Proving Ground. I remember very well that when the organization was first established I felt that sooner or later this interest would die out. My apprehensions were without foundation, because the organization grew and prospered."

The new Post draws its members not only from the students and faculty of the university but from the regular members of the Association resident in and near Ann Arbor. At a meeting held on March 20th the following permanent officers were elected for the coming year: president, Raymond Gauthier; vice-president, Douglas Knight; corresponding secretary, Verne Kennedy; recording secretary-treasurer, Larry Shipman; executive secretary and treasurer, Jacque Van Gieson. The board of directors of the new Post will consist of these officers and three other faculty and Association members of Ann Arbor. Mr. Van Gieson, who served as temporary secretary and treasurer, and W. G. Frailing, who was temporary chairman, were the organizers of the new Post and both were tendered enthusiastic thanks at the inaugural meeting.

CHICAGO POST

MAJ. Gen. C. M. Wesson, Chief of Ordnance, U. S. Army, was the principal speaker at a national-defense dinner at Chicago on March 17, 1941. The dinner was under the auspices of the Chicago Post, Army Ordnance Association; Illinois Manufacturers' Association, and Illinois Manufacturers' Costs Association. It was held in the ballroom of the Palmer House where more than 1,400 members and guests were in attendance. James S. Knowlson, president, Stewart-Warner Corporation,

also addressed the meeting. He discussed his experiences as a manufacturer who has set aside a large portion of his plant for Army and Navy work. He commended the Ordnance Department on its efficient coöperation with arms manufacturers. Edmund A. Russell, president of the Chicago Post and former chief of the Chicago Ordnance District, was toastmaster. Other speakers were Fred A. Preston, chief of the Chicago Ordnance District; Col. Donald Armstrong, executive officer of the district, and Lieut. Col. L. A. Codd, editor of ARMY ORDNANCE.

The meeting was the largest ordnance gathering ever held in Chicago and attested the interest of executives and engineers of industry in that area in the armament program.

General Wesson's address, which was delivered at the meeting, is published in full as the leading article of this issue (page 597).

WASHINGTON POST

BRIG. Gen. R. L. Maxwell, Administrator of Export Control, and former editor of ARMY ORDNANCE, was the principal speaker at the monthly meeting of the Washington Post, March 11th. The meeting, held at the Raleigh Hotel, was attended by nearly 200 members and guests. Col. F. H. Miles, Jr., president of the Post, presided.

Among the special guests were Maj. Gen. C. M. Wesson, Chief of Ordnance; Maj. Gen. William Crozier, former Chief of Ordnance, and Brig. Gen. Earl McFarland, Assistant to the Chief of Ordnance.

General Maxwell described the organization and policies of the Export Control Administration. He said in part:

"Last spring and summer, as our rearmament program got under way, we quickly became cognizant of those shortages in the capital-goods end—the capital goods which produce the machines which produce the guns and the tanks and the planes we need so badly. Along with our shortages in the capital-goods field, we found that there were many shortages, or potential shortages, in the raw materials—raw materials which must be fed into these capital goods if we are to have the finished products. The country's experts in military procurement methods—the Army and Navy Munitions Board—had pointed out for years the strategic or critical condition of some of our raw materials.

"As our program got under way, we found it necessary to institute certain controls—certain measures to insure maximum productivity with minimum waste—to insure that that which we needed would be produced. We found many types of controls available; most of those we examined have been instituted by certain other countries. Some, or appropriate parallels, we have instituted so far, others remain potential aids that can be utilized if the need arises—some we would dislike to see applied in a democracy. A number of these controls are directly applicable to production and foreign trade, the field in which my staff and I are especially interested. . . .

"Take aluminum, for example. You have seen much in the press about it recently. In 1939 we exported huge amounts—exceeding 18,000,000 pounds in one month alone. This drain from the country was continued in 1940—for we had no way of stopping it. You know of aluminum's civilian uses—the pots and the pans, the civilian airplanes and the cars, the machines and the toys in which it is used in such quantities. But supplementing these normal civilian demands with tremendous military, non-normal demands, brought us face to face with a situation that could become quite unpleasant.

"So last July—when our authority to control exports in the name of national defense was instituted—aluminum was on the first list of those articles and materials which could not be exported without a license. This, then, was the first control. By this measure, we were enabled to conserve amounts needed in this country and also to utilize a second control—that of directional exportation. In the positive sense, this directional exportation control means we can permit exports of aluminum to those countries we wish, such as Great Britain and Canada. Also, the means are at hand to deny exports to such countries as we desire or to limit exports to certain normal-business levels. Needless to say, the passage today of the long-debated Lease-Lend Act will but permit us to expedite aid to those countries we have been assisting to date. Thus, by placing an article or material under control, we immediately and directly assure ourselves of two controls: that of *amount* going out of the country, and that of *where* it is to go.

"But back to aluminum: For eight months this export control was sufficient. Then, as demands grew for aluminum (for example, some 6,000 pounds of this metal are needed for *one* airplane of a certain type) the nation was forced to utilize another control—that of *priority*.

"Priority normally refers to domestic allocation, whereas export control calls for control of that which leaves our country. Inherently, however, it is but another form of priority. The utilization of priority control, like that of export control, creates two subsidiary controls; that of direction and that of price.

"A third broad field of controls is requisitioning. We have utilized it to some extent in our work. Under this requisitioning authority, an article or material denied an export license can be requisitioned if the owner is unable or unwilling to negotiate for its sale. Following such requisition, or physical taking over of the property, it is used in our own defense effort. This type of requisitioning is, of course, not to be confused with the authority given the President, under the Selective Service Act, to take over noncoöperative plants. To date, there has been no need to utilize that control, for we in the defense effort have had complete coöperation from manufacturers and business men."

BOSTON POST

THE Boston Post, Army Ordnance Association, participated with the Boston Chapter, American Society for Metals, in a national-defense meeting held at the Chamber of Commerce, Boston, April 4th. Nearly 300 members of both societies were in attendance. At 5 o'clock in the afternoon an exhibit of components of ordnance matériel was held in the lounge of the Chamber of Commerce building. The exhibit was under the general direction of Maj. Philip E. Gruber, Boston Ordnance District, assisted by Horace Ross, a member of the Boston Chapter, A.S.M. Dinner was served at 6:30.

R. F. Harrington presided at the technical session which followed. Addresses were made by Lieut. Col. C. S. Robinson, president of the Boston Post, A.O.A.; Lieut. Col. J. S. Crawford, executive officer, Boston Ordnance District, and Lieut. Col. L. A. Codd, Ord. Res., editor of ARMY ORDNANCE. Among the special guests were Brig. Gen. R .W. Case, commanding officer, Watertown Arsenal; Lieut. Col. Scott B. Ritchie of the arsenal staff; Col. T. L. Ames, U. S. Army, Ret., former commanding officer of the Springfield Armory; Col. Charles E. Fuller, dean of Army officers, Massachusetts Institute of Technology, and Lieut. Col. Nathaniel C. Nash, president, National Rifle Association.

NEW MEMBERS

DURING the period February 1, 1941, to March 31, 1941, inclusive, the following applicants were admitted to membership in the Army Ordnance Association: Earl G. Abbe, Longmeadow, Mass.; A. A. Acklin, Atlanta, Ga.; George T. Adams, Wilmington, Del.; Leon Adler, Washington, D. C.; Claud E. Aikman, San Angelo, Tex.; B. W. Ainsworth, Fairfield, Conn.; Donald D. Alexander, Aberdeen Proving Ground, Md.;

Charles K. Allen, Fort Devens, Mass.; H. G. Allen, Buffalo, N. Y.; Stanton Allen, Ann Arbor, Mich.; John W. Anderson, Indianapolis, Ind.; Harry C. Armin, Brooklyn, N. Y.; John E. Arnold, South Hamilton, Mass.; W. R. Atkinson, Lancaster, Pa.

Julius I. Bach, Washington, D. C.; Malcolm Bailey, Sr., Tampa, Fla.; Clarence D. Barnhart, Brooklyn, N. Y.; Michael J. Barry, Chicago, Ill.; Percy L. Barter, Detroit, Mich.; Joseph H. Bascom, St. Louis, Mo.; Orville Baxter, Indianapolis, Ind.; Clarence H. Beach, Indianapolis, Ind.; Charles H. Beardsley, Washington, D. C.; Ralph H. Beaton, Columbus, Ohio; K. A. Beier, Indianapolis, Ind.; G. J. Bell, Milwaukee, Wis.; George M. Bell, Washington, D. C.; Vincent E. Bender, Watertown, Mass.; Richard E. Benecke, Scarsdale, N. Y.; Edward B. Bennett, Steubenville, Ohio; Roy Bennett, New York, N. Y.; Carl Benson, New Haven, Conn.; Ernest A. Berger, Whitemarsh, Pa.; J. Alfred Berger, Pittsburgh, Pa.; Walter R. Berger, Jr., Norman, Okla.; Tell Berna, Cleveland, Ohio; Jules E. Bernard, New York, N. Y.; Francis A. L. Bickel, Lakewood, Ohio; Oscar Bieshelt, Salem, Ohio; G. W. Binns, Cincinnati, Ohio; Waldo H. Blackmer, Larchmont, N. Y.; H. E. Blasingham, Indianapolis, Ind.; Arthur B. Blocksidge, Jr., Pittsburgh, Pa.; Emil Bloomquist, New Haven, Conn.; Harry S. Blumberg, New York, N. Y.; J. F. Bode, Milwaukee, Wis.; William H. Bokum, Old Greenwich, Conn.; Basil T. Bonnot, Canton, Ohio; Harry J. Borde, Stanford University, Calif.; Orlan W. Boston, Ann Arbor, Mich.; Walter C. Bowman, Chicago, Ill.; James K. Boyd, Elkton, Md.; F. W. Boye, III, Cincinnati, Ohio; C. M. Bradford, Meriden, Conn.; Roy T. Bramson, Detroit, Mich.; A. J. Brandt, Detroit, Mich.; W. R. Breeler, Dunkirk, N. Y.; H. F. Briggs, Buffalo, N. Y.; Raymond G. Briggs, Buffalo, N. Y.; Edward G. Brogan, Springfield, Mass.; William J. Bromley, Grants Pass, Oreg.; John P. Brosnahan, Bethlehem, Pa.; Donaldson Brown, New York, N. Y.; S. C. Brown, Cleveland, Ohio; George E. Brumbach, Reading, Pa.; Oren W. Bryant, Henderson, Ky.; Joseph H. Bryson, Augusta, Ga.; Harold F. Buck, Washington, D. C.; R. E. Buckholdt, Salem, Ohio; Philip N. Buckminster, Highland Park, Mich.; William J. Buechling, Warren, Ohio; James H. Burchett, Torrance, Calif.; W. E. Burdick, Vultee Field, Calif.; Walter C. Burger, Alhambra, Calif.; Bernard A. Burke, New York, N. Y.; Charles E. Burns, Jr., Washington, D. C.; John R. Burton, Jr., Far Rockaway, N. Y.

John J. Cadot, York, Pa.; Clarence B. Callomon, Los Angeles, Calif.; Lloyd E. Campbell, Bristol, Pa.; Milton E. Canfield, Los Angeles, Calif.; Robert W. Canfield, Bethesda, Md.; Emil R. Capita, Flushing, N. Y.; P. W. Carbaugh, Rockford, Ill.; F. S. Carpenter, Los Angeles, Calif.; Don I. Carroll, Vultee Field, Calif.; Sam A. Carrousos, Rochester, N. Y.; Allen J. Carruthers, Springfield, Mass.; Donald R. Carse, New York, N. Y.; E. H. Casavant, Hartford, Conn.; Philip B. Case, Ann Arbor, Mich.; Albert B. Castro, Wilkinsburgh, Pa.; L. Edward Chance, St. Louis, Mo.; Earl V. Chettle, Ogden, Utah; John A. Clark, Hartford, Conn.; Charles Y. Clayton, Rolla, Mo.; John F. Cleaveland, Peapack, N. J.; William F. Clewe, Jr., Alhambra, Calif.; Robert S. Clingan, Chicago, Ill.; Albert W. Clurman, New York, N. Y.; W. N. Cochran, Atlanta, Ga.; H. L. Coe, Washington, D. C.; M. R. Collins, Jr., Augusta, Ga.; James W. Compas, Downey, Calif.; Stephen A. Compas, Huntington Park, Calif.; E. W. Conarton, Jersey City, N. J.; L. S. Cooch, Kenmore, N. Y.; Alvin G. Cook, Dunkirk, N. Y.; Peter E. Costello, Baltimore, Md.; C. L. Coughlin, Milwaukee, Wis.; Neal D. Crane, Cambridge, Mass.; William F. Crawford, Chicago, Ill.; Harry Cronk, Waukesha, Wis.; Robert W. Crozier, New York, N. Y.; Raymond G. Curtin, Alexandria, Va.; Sydney F. Curtis, Jamaica, N. Y.

Maurice J. Dalby, Ann Arbor, Mich.; Virgil F. Davico, Teaneck, N. J.; Richard F. Davis, Cincinnati, Ohio; Arthur V. Deal, Fort Monroe, Va.; Roger G. DeLong, Racine, Wis.; W. A. DeRidder, Los Angeles, Calif.; Norman L. Deuble, Warren, Ohio; R. P. Dickerman, Southington, Conn.; Charles Diehl, Jersey City, N. J.; William A. Dilks, Philadelphia, Pa.; William A. Dinger, West Caldwell, N. J.; Harry Dittmar, Canton, Ohio; Richard H. Donahue, Dover, N. J.; Charles R. Donovan, Washington, D. C.; John H. Downer, Chicago, Ill.; Arthur G. Drefs, St. Louis, Mo.; Edwin S. Drowne, Jr., Newton Highlands, Mass.; James T. Duffy, Jr., York, Pa.

Cuno Eichman, Shaker Heights, Ohio; Steve Elek, Dayton, Ohio; Edward Elliott, Worcester, Mass.; Maurice A. Embertson, Detroit, Mich.; Birger Engstrom, Pittsburgh, Pa.; R. H. Erichsen, New York, N. Y.; Edward L. Erickson, Evansville, Ind.; Louis H. Erickson, Chicago, Ill.; James L. Erwin, Shaker Heights, Ohio; G. Walter Esau, Eggertsville, N. Y.; Swan Esborne, Branford, Conn.; Selmer J. Espelund, Aberdeen Proving Ground, Md.; Lloyd G. Evans, Johnstown, Pa.

A. J. Feirich, Buffalo, N. Y.; E. J. P. Fisher, Salem, Ohio; Charles H. Fitch, Kenmore, N. Y.; Justin A. Fitz, Brooklyn, N. Y.; J. W. Fitzgerald, Milwaukee, Wis.; M. W. Flader, Kohler, Wis.; Poul Flamand, Lancaster, Pa.; T. B. Flanagan, Columbus, Ohio; George E. Fogarty, Seneca Falls, N. Y.; Le Grand B. Fonda, Troy, N. Y.; A. P. Fontaine, Ypsilanti, Mich.; E. B. Forslund, Philadelphia, Pa.; Everette M. Foster, Oak Park, Ill.; F. E. Foster, Freeport, N. Y.; Thomas G. Foulkes, Bethlehem, Pa.; Samuel Frankel, New York, N. Y.; Hennig Frantz, New Haven, Conn.; Paul E. Frantz, Euclid, Ohio; Arthur W. Frenzel, Jr., Los Angeles, Calif.; Robert T. Frisbie, Jr., Evanston, Ill.; J. A. Fry, Columbus, Ohio; Lowell C. Freeman, Detroit, Mich.; Ray W. Fuller, Pelham, N. Y.; John L. Furey, Livingston, N. J.

Lewis F. Gadbois, Kenmore, N. Y.; Albert H. Galbraith, Staten Island, N. Y.; George F. Gales, Langley Field, Va.; Harold L. Gardner, Shaker Heights, Ohio; R. P. Garrison, Dayton, Ohio; S. Douglas Gibson, Washington, D. C.; Thomas F. Githens, Cleveland, Ohio; Samuel D. Gladding, Bethlehem, Pa.; David M. Goldsmith, Chicago, Ill.; R. T. Goodwin, New York, N. Y.; O. F. Gottlieb, Milwaukee, Wis.; Walter Stephen Grabowsky, Detroit, Mich.; William J. Graham, Oak Park, Ill.; S. R. Graziano, Brooklyn, N. Y.; Charles H. Greenall, Larchmont, N. Y.; Omar V. Greene, Fleetwood, Pa.; A. T. Greiner, Salem, Ohio; R. W. Griffith, Milwaukee, Wis.; John A. Grodrian, Chicago, Ill.; Russell R. Gross, Shelbyville, Ind.

W. W. Hall, Warren, Ohio; Samuel H. Hallowell, Rochester, N. Y.; Jake L. Hamon, Dallas, Tex.; Samuel S. Hansen, Los Angeles, Calif.; Charles B. Harbin, Atlanta, Ga.; Samuel T. Harleman, Bethlehem, Pa.; Kenneth A. Harmon, Longmeadow, Mass.; Norman T. Harrington, East Cleveland, Ohio; Richards H. Harrington, Schenectady, N. Y.; Allen Harrison, Washington, D. C.; DeSales Harrison, Atlanta, Ga.; W. B. Hartsfield, Atlanta, Ga.; Francis W. Haskell, Washington, D. C.; Lefferd B. Haughwout, North Ridgeville, Ohio; P. N. Hauser, Wauwatosa, Wis.; Charles W. Hawker, Fort Snelling, Minn.; G. J. Hawkey, Euclid, Ohio; Edwin N. Hazlett, Cleveland, Ohio; Roger A. B. Heap, Longmeadow, Mass.; Harry W. Heffner, Hot Springs, Ark.; James J. Heger, Beaver Falls, Pa.; Carl A. Heinze, Hollywood, Calif.; Jack C. Heist, Cambridge, Mass.; C. W. Henkle, Chicago, Ill.; John H. Herczogh, Perth Amboy, N. J.; Conrad Hibbeler, New York, N. Y.; Axel G. Hildebrand, Brooklyn, N. Y.; Peter F. Hilder, Washington, D. C.; F. J. Hillwig, Lockport, N. Y.; William H. Hinchliffe, New York, N. Y.; George W. Hobby, Jr., Wyandotte, Mich.; George F. Hocker, Bethlehem, Pa.; Don M. Hoffman, Joliet, Ill.; Fred Hoke, Indianapolis, Ind.; A. C. Holden, Chicago, Ill.; Harry B. Holland, Buffalo, N. Y.; Walter T. Holmes, Rochester, N. Y.; Edgar R. Holstein, Grove City, Pa.; Donald A. Holt, Niagara Falls, N. Y.; Paul S. Horst, South Gate, Calif.; B. M. Horter, Milwaukee, Wis.; Dallas L. Hostetler, Canton, Ohio; George M. Huck, San Marino, Calif.; Edward Huffman, Indianapolis, Ind.; Edgar

L. Hunter, Baltimore, Md.; George E. Hurt, New York, N. Y.; J. T. Irvine, New York, N. Y.

E. N. Jacobi, Milwaukee, Wis.; Prescott B. Jensen, Indianapolis, Ind.; Bjornulf Johnsen, New York, N. Y.; Albert K. Johnson, Los Angeles, Calif.; E. F. Johnson, Washington, D. C.; Ernest R. Johnson, Massillon, Ohio; Hugo E. Johnson, Mt. Lebanon, Pa.; E. F. Johnstone, Jr., Burlington, Iowa; Harrison Jones, Atlanta, Ga.; George W. Jordan, Norman, Okla.; Joseph F. Joy, Washington, D. C.

Carl Kalbfleisch, Dayton, Ohio; C. M. Kaltwasser, Wayne, Mich.; Gordon B. Kaufmann, Los Angeles, Calif.; George T. Keller, Jr.; Evansville, Ind.; Paul Keller, Cleveland, Ohio; James C. Kelley, Alhambra, Calif.; Ben. F. Kells, Chicago, Ill.; J. Frank Kelly, Willimansett, Mass.; W. T. Kelly, Jr., New York, N. Y.; Aldrich D. Kendall, Lakewood Village, Calif.; C. M. Kendig, Lancaster, Pa.; Jay Richard Kennedy, New York, N. Y.; R. Eugene King, Cincinnati, Ohio; L. T. Kittinger, New York, N. Y.; W. B. Klee, Jr., Warren, Ohio; Samuel J. Klein, New York, N. Y.; Lawrence J. Kline, Chicago, Ill.; William W. Knight, Jr.; Washington, D. C.; Edward M. Kolman, Brooklyn, N. Y.; Norman Korff, Chicago, Ill.; O. A. Kresse, Torrance, Calif.; E. G. Kuhn, Buffalo, N. Y.; William G. Kussmaul, Cambridge, Mass.

William C. Larsen, Aberdeen Proving Ground, Md.; D. M. Laird, Columbus, Ohio; Percy Edward Landolt, New York, N. Y.; John A. S. Lane, Milwaukee, Wis.; Harold E. Lange, Long Beach, Calif.; Fred L. Lawrence, Detroit, Mich.; H. R. Lawrence, Lancaster, Pa.; H. Langdon Laws, Cincinnati, Ohio; Seward N. Lawson, Detroit, Mich.; J. H. Lee, New York, N. Y.; Robert C. Leech, Watertown, Mass.; H. H. Leonard, Buffalo, N. Y.; Edward A. LeVay, Baltimore, Md.; Stanley, Levison, New York, N. Y.; James W. Linhart, Turtle Creek, Pa.; Andrew W. Loebl, New York, N. Y.; Andrew Loewi, New York, N. Y.; Joseph Loewi, New York, N. Y.; Charles P. Lohman, Baltimore, Md.; Samuel S. Long, Newark, N. J.; Harry A. Louret, Riverside, Ill.; J. H. Loux, Salem, Ohio; A. H. Lowe, San Francisco, Calif.; George P. Luckey, Lancaster, Pa.; William S. Lyhne, Indianapolis, Ind.

Samuel D. Magavern, Buffalo, N. Y.; William J. Magavern, Buffalo, N. Y.; Walter C. Main, Los Angeles, Calif.; Vincent T. Malcolm, Indian Orchard, Mass.; Edmund Male, North Haven, Conn.; M. F. Manby, Lancaster, Pa.; C. N. Mansur, Fitchburg, Mass.; G. Adolph Markuson, Rockford, Ill.; William Paul Martin, Pittsburgh, Pa.; Ray Matzen, Milwaukee, Wis.; Charles Maudlin, Indianapolis, Ind.; Edward T. McBride, Hawthorne, N. J.; John J. McCloy, Washington, D. C.; Carl McGovney, Downey, Calif.; Augustus T. McKee, Buffalo, N. Y.; James F. McKeone, Kenmore, N. Y.; J. W. McLean, Philadelphia, Pa.; Edward J. McManus, Orange, N. J.; Russell G. McMillen, Cleveland, Ohio; W. F. McNally, Mt. Lebanon, Pa.; Vance McVey, West Haven, Conn.; Lannon F. Mead, Rahway, N. J.; Lawrence Mehren, Vultee Field, Calif.; W. Layton Meisle, Wauwatosa, Wis.; L. F. Meissner, Jr., Pittsburgh, Pa.; J. B. Mentzer, Waynesboro, Pa.; George A. Meyer, Richmond Hill, N. Y.; A. F. Milbrath, Milwaukee, Wis.; Louis R. Millar, Chicago, Ill.; Carroll E. Miller, Windsor, Vt.; Philip A. Miller, Shelburne Falls, Mass.; Kenneth T. Milne, Pendleton, Ind.; Harold E. Milz, Chicago, Ill.; Ralph S. Minor, Jr., Stockton, Calif.; Harry M. Mitchell, Rye, N. Y.; J. Hanson Mitchell, Baltimore, Md.; Marvin C. Moffett, Coatesville, Pa.; Lester E. Mohrbacher, New Brighton, Pa.; T. G. Moore, Cleveland, Ohio; Herman A. Moorhead, Pittsburgh, Pa.; Albert W. Morris, Springfield, Mass.; Walter S. Morris, Berwick, Pa.; John W. Mull, Jr., Indianapolis, Ind.; Henry J. Mullen, Fairlawn, N. J.; Joseph Mullen, St. Louis, Mo.; Paul F. Mumma, McKeesport, Pa.

R. J. Nadherny, Chicago, Ill.; Robert R. Nathan, Washington, D. C.; Ambrose L. Naughton, Berwick, Pa.; K. B. Neff, Columbus, Ohio; Lloyd S. Nelson, Borinquen Field, P. R.; Claude L. Newhart, Cincinnati, Ohio; Elbert A. Newhouse, Metuchen, N. J.; Charles M. Newman, New York, N. Y.; A. J. Newsome, Indianapolis, Ind.; E. B. Nichols, Jr., Moorestown, N. J.; C. I. Niedringhaus, Pittsburgh, Pa.; Charles A. Niemela, Roscoe, Pa.; Herbert J. Noble, Collegeville, Pa.; James A. Nolan, Rochester, N. Y.; Raymond G. Nordstrom, Swissvale, Pa.; Edward M. Norton, Cincinnati, Ohio; Phil Norton, Milwaukee, Wis.; F. E. Null, Ridgefield, N. J.

William H. Obenour, Arlington, Va.; E. J. O'Brien, Watertown, Mass.; Richard A. O'Connor, Fort Wayne, Ind.; William H. Odiorne, Los Angeles, Calif.; Edward V. Oehler, Milwaukee, Wis.; Daniel L. Ogden, Woodbridge, N. J.; Warren B. Ogden, Chicago, Ill.; Bruno J. Olender, Fort Wayne, Ind.; Frank J. Olender, Fort Wayne, Ind.; Joseph Olender, Indianapolis, Ind.; A. F. Olson, Fitchburg, Mass.; Louis R. Ostrow, Brooklyn, N. Y.; Louis W. Oswald, Pittsburgh, Pa.

C. R. Pafenbach, Lockport, N. Y.; Richard W. Palmer, Vultee Field, Calif.; R. O. Palo, Inglewood, Calif.; Graham W. Parker, Washington, D. C.; A. W. Parsons, Indianapolis, Ind.; J. A. Paulsen, New York, N. Y.; H. A. Pavitt, Fitchburg, Mass.; John D. Peace, Jr., Hoboken, N. J.; John D. Pearson, Buffalo, N. Y.; E. M. Pendleton, Waterbury, Conn.; C. W. Perelle, Vultee Field, Calif.; Bertel T. Perry, Franklin, Pa.; John G. Pew, Dallas, Tex.; Horace P. Phillips, San Mateo, Calif.; Alfred J. Piecuch, Cincinnati, Ohio; Anthony Pinto, New York, N. Y.; A. D. Potts, Lockport, N. Y.; Nathan C. Price, Hollywood, Calif.; Paul L. Purvine, Aberdeen Proving Ground, Md.; Charles W. Quimby, Philadelphia, Pa.

John C. Raaen, Jr., West Point, N. Y.; C. S. Reese, Lancaster, Pa.; L. G. Regner, Milwaukee, Wis.; William Reiff, Jr., Cleveland, Ohio; Edward M. Reilley, Jr., Pittsburgh, Pa.; Paul Renshaw, New York, N. Y.; Harrison G. Reynolds, Washington, D. C.; Daniel Roblin, Jr., Buffalo, N. Y.; John C. L. Rogge, New York, N. Y.; Jack A. Roll, Cincinnati, Ohio; A. J. Rose, Greenville, Pa.; Wynn F. Rossiter, Deerfield, Mass.; E. R. Rothert, North College Hill, Ohio; Arthur Rozzi, Mariemont, Ohio; Don W. Ryker, Ann Arbor, Mich.

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NECROLOGY

SWAGAR SHERLEY, a director of the Washington Post of the Army Ordnance Association for many years, and the distinguished chairman of the Appropriations Committee of the House of Representatives during the World War, died at his home in Louisville, Ky., February 13, 1941.

Mr. Sherley, a close adviser to President Wilson, served in the Congress from 1913 to 1919. He had engaged in the practice of law in Washington for the past twenty years. An aggressive, plain-spoken man, Mr. Sherley's service as chairman of the House Appropriations Committee during World War years was especially noteworthy. It had been said that he directed more great appropriations through the House than any other Representative. In 1935 he represented the United States Government in negotiations with Canada over mining claims. By reason of his knowledge of Government finance and budgeting, was a close adviser to President Rooosevelt in 1932 and 1933.

Mr. Sherley was a colorful figure in the House of Representatives. He was noted for his oratory and his picturesque ways. One of the many epigrams he coined was: "Unpreparedness is the price which a nation pays for democracy."

His allegiance to industrial preparedness had been strong since his first service to it in the World War. He was a frequent figure at the annual meetings of the Association at the Aberdeen Proving Ground and was much interested in the affairs of the Washington chapter. His service to both organizations and to the nation at large was of the very highest character and will endear his memory for many years to all proponents of armament preparedness.

LIEUT. COL. WALTER MANGUM, Ord. Res., charter member of the Army Ordnance Association, died at Washington, D. C., April 1, 1941. He had long been associated with ordnance engineering in this country and abroad. In recent years he was an active member of the Washington chapter.

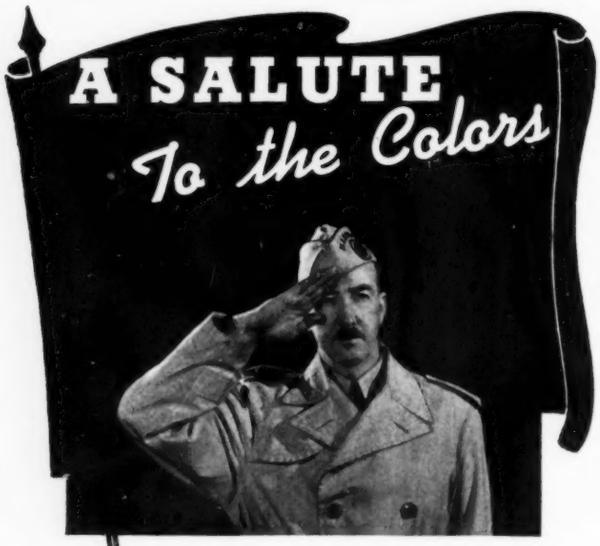
A graduate of the University of Georgia Law School, he became city editor of the *Savannah Press* at the age of twenty-one. During the World War, as a lieutenant of the Naval Reserve he served at the Charleston Navy Yard, S. C., and later with the destroyer flotilla. Following the war he represented various American interests at Calcutta, India, and in 1924 took up his residence at London where he served as commander of the American Legion in the British Isles and chairman of the American Society of London. In 1934 he returned to Washington as deputy administrator in the National Recovery Administration, and in 1936 resumed his private business affiliations.

Colonel Mangum, by reason of his long years of contact with ordnance affairs in this country and abroad, had many friends in the Army Ordnance Association. His abilities as a Reserve officer and his experience were always gladly given to the Army and to the Association. His death at a time when his knowledge and enterprise were of exceptionally great value is a serious loss to the organizations with which he was connected and to his many friends who will revere his memory.

WILLIAM B. UPDEGRAFF, formerly a director of the New York Post, Army Ordnance Association, and for many years an active member of the society, died February 13, 1941, in New York City. He was an executive of the Watson-Stillman Company, Roselle, N. J., with which company he had been connected for twenty-five years. He was an inventor of several improved mechanical engineering devices and was closely affiliated with ordnance production, particularly in the field of hydraulic machinery.

Well known as a mechanical engineer, Mr. Updegraff installed and operated the first marine turbine built in America. Among his inventions are the turbine clearance indicator, lead covering die block for cable covering, and tunnel shield equipment for subaqueous tunnels. Mr. Updegraff gave willingly of his time and effort in the solution of ordnance problems. He was particularly active in the New York chapter through many years, where his genial personality and zeal will be especially missed.

NOTICE also has been received of the death of the following members of the Association: G. E. Beggs, Princeton, N. J.; William W. Crawford, Chicago, Ill.; Francis D. Jackson, New York, N. Y.; Edmund Lang, New York, N. Y.; Walter F. Moyer, Philadelphia, Pa., and W. P. Pickhardt, New York, N. Y.



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Ordnance in Review

THE JOHNSON LIGHT MACHINE GUN

BY LIEUT. COL. CALVIN GODDARD

THE years elapsing since the close of the World War have witnessed the introduction of a veritable spate of new machine-gun mechanisms, embodied in everything from the tiny "sub" weapons of 6½ pounds and upward, firing pistol ammunition, to heavy, water-cooled, tripod-mounted affairs. The intermediate class of "light" machine guns likewise has received attention, and many have appeared—some taking shape as machine rifles of the type exemplified in the United States by the light Brown-

THE JOHNSON LIGHT MACHINE GUN

ing of 1918, others adapted for use either off-shoulder or with muzzle supports in the form of bipods, etc.

According to Curti ("Automatische Waffen," Frauenfeld, Germany, 1936), the only characteristic possessed by these in common is the absence of a rigid mount. He goes on to say that even without such a support the current German light machine gun can be fired in bursts numbering up to the full capacity of the magazine without the sights riding up off the target, or without any impairment of accuracy up to 1,000 meters. The attainment of such characteristics with a weapon of conventional form is not easy. To achieve them, the makers of the German Solothurn M.34 (the piece to which Curti refers) have undertaken distinct departures from general practice, in the conformation of its "straight-line" stock, and in the mounting of its sights high above the bore.

Both these features are to be found in an American contribution to the light-machine-gun field—that of Capt. Melvin M. Johnson, Jr., Marine Corps Reserve. This arm, the basic elements of which were invented in 1936, progressed into a fully automatic model in 1937 and, in 1940, was finally modified into the current form in which it is capable both of semi- and full-automatic fire. The following is a brief review of the Johnson's specifications:

Caliber: .30 (M1906), M1 or M2; Action: short-recoil type; Weight (less magazine): 12.3 pounds; Weight of magazine, empty: 14 ounces; Barrel length: 20, 22 (standard), and 24 inches; Over-all length: 42 inches; Cooling system: air; Magazine type: single-column box; Magazine capacity: 20 rounds (capacity of gun fully loaded is 25 rounds); Magazine location: extends horizontally from left side of receiver; Methods of loading: (1) by inserting loaded detachable magazine; (2) with magazine in place, by inserting 5-round clips or single rounds through loading port on right side of receiver; Time required to remove empty magazine and insert loaded replacement: 3-5 seconds; Line of sight—height above axis of bore: 2 inches; Sight radius: 28 inches; Number of parts to remove for field cleaning: 11; Time required for stripping: 35 seconds; Tools required for disassembly: point of bullet in cartridge; Cyclic rate of fire with normal buffer tension: 400-450 M2

rounds a minute (rate adjusted by varying tension on buffer spring); Range of adjustment: from about 300 to 900 rounds a minute; Time elapsed in firing one full-automatic burst of 20 rounds: slightly over 2 seconds; Actual number of rounds delivered, full-automatic, 1-man operation: 180 a minute—with 2-man crew (assistant replacing magazines): 200-220 rounds a minute; Time required for barrel removal: 4-5 seconds; Time required for barrel removal and replacement: 8-10 seconds; Types of fire: semi- and full-automatic; Safety: positive sear lock.

Reference already has been made to the design of the Johnson stock, the unusual lines of which will be noted upon inspection of the illustration (p. 644). The atypical outlines there revealed are the result of a highly successful effort to reduce the usual tendency of an arm of this class to "climb" during full-automatic fire as well as to eliminate, in so far as possible, the concomitant vibration. As an additional gesture toward these ends the mechanism is so fashioned that all moving parts reciprocate along the axis of the bore, the combination of these novel features constituting one of the outstanding characteristics of the piece.

ANOTHER interesting and apparently highly desirable departure from convention appears in the manner in which the bolt functions during semiautomatic, as contrasted with full-automatic, fire. In the Johnson weapon, when set for semiautomatic operation (where the contingency of spontaneous ignition is negligible), the bolt is cocked and locked in the forward (closed) position as in an ordinary bolt-action rifle, a loaded cartridge filling the chamber ahead. Firing takes place in the usual manner—by removing the safety and pressing the trigger, no more vibration being set up than in a nonautomatic arm. Should full-automatic fire now be indicated, the change lever is turned to the rear, the bolt thereafter remaining retracted and the chamber empty, until firing is begun. The mechanical design involved provides for engagement of trigger and sear during semiautomatic fire, but when the operation is fully automatic, engagement is between trigger and bolt catch, sear and sear trip. Trigger pressure now releases the bolt which trips the sear in locking, thus releasing the hammer and discharging the piece.

When vertically positioned, the change lever locks both sear and bolt catch, making it impossible to fire with the bolt in either the open or closed position. An additional safeguard is provided in a grip safety located just below the rear end of the trigger guard.

The Johnson possesses yet additional, and seemingly substantial, claims to fame. It manages to eliminate entirely malfunctions due to deformations of magazine lips made integral with a detachable-box magazine, bugbears which long have troubled users of such devices (and it requires but few fingers to count the varieties of box magazines *not* possessing integral lips). The device employed to accomplish this consists of a flat-leaf spring with a rounded hook which fulfills two functions: the first, to engage and retain the top cartridge in the magazine; the second, to act as the magazine retaining catch. Upon insertion of the magazine into its holder on the left side of the action, this hook is cammed upward on a ramp, whereupon it first releases the cartridges from the magazine, then engages upon shoulders in the ramp to prevent the disengagement of the magazine unless and until the proper release lever is actuated.

Once released, the cartridges are forced from the magazine against the cartridge guide or side ramp which constitutes a part of the magazine loading cover. Pressure of the magazine spring against this ramp results in the top cartridge being rolled up into feed lips which are *machined* into the receiver. This mode of construction obviates the danger of lip distortion.

By depressing the magazine loading cover, the ramp formed on the right side of the feed lips is removed, and the contents of the magazine are forced out into the hand of the operator. By means of this same cover it becomes possible to clip-load cartridges directly into the gun from the *right* side of the receiver.

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a clip seat, identical with that found in the Johnson semiautomatic rifle of rotary-feed type, being provided for the purpose. Furthermore, single cartridges may be introduced in like manner. Since the operator may find an opportunity to refill the magazine after discharging only a portion of its contents, such a feature becomes extremely advantageous. Thus, after firing five or ten shots, he may refill the magazine by the simple expedient of introducing one or two clips of ammunition—the magazine meantime remaining in the weapon. Moreover, should the firing of tracer ammunition suddenly be indicated, a suitable number of rounds of ball ammunition may be removed by depressing the magazine loading cover and replaced directly by as many tracers. Incidentally, the Johnson magazine is of the single-column box type which has much to recommend it by way of simplicity and large tolerances in manufacture.

IN THE-matter of design, Johnson's gun consists of five basic groups of components: (1) barrel group, (2) bolt group, (3) receiver group, (4) magazine group, (5) buttstock and hammer group. For complete field stripping, it is necessary to remove but eleven parts: barrel, butt group, magazine, magazine holder, bolt, extractor, firing-pin stop, firing pin, operating handle, locking cam, and receiver group. Such removal has been accomplished in fifteen seconds and replacement in thirty-five seconds.

The locking action involves a rotary bolt which locks by rotating through an arc of twenty degrees, thereby effecting the engagement of eight locking lugs disposed equidistant one from another about the bolt head. Lug faces are square, without bevel. Lugs mate with a corresponding number of similarly disposed segments or abutments in a barrel-locking bushing, resting against these when in the locked position. A locking cam, positioned at the rear end of the bolt group, effects rotation and locking of the bolt after the latter has reached its fully closed position. Since the cam unit carries the firing pin, unlocking the bolt results in sufficient retraction of both cam and firing pin to prevent discharge until the bolt assembly reassumes its fully locked state.

When the piece is discharged, barrel and bolt recoil together for about one-eighth of an inch, whereupon the angular face of the operating cam contacts a corresponding face in the receiver. This causes the bolt to rotate through the twenty degrees required for unlocking, during which period it travels rearward to the extent of something less than an additional three-eighths of an inch. Total barrel travel in recoil is less than seven-sixteenths of an inch. Unlocking is completed only after residual pressure has fallen to within practicable limits, but there remains at this time sufficient pressure to assist in the retraction of the bolt assembly. Thus recoil alone effects the unlocking; recoil momentum *plus* residual pressure effects the subsequent retraction. Primary extraction derives from the momentum of recoil. Compression of the coil mainspring, which lies on a prolongation of the axis of the bore, results from the rearward movement of the bolt assembly. As the bolt passes the rear of the magazine, the buffer plunger at the rear of the locking cam is compressed as a result of contacting the base of the mainspring tube in the buttstock. The bolt, its motion now reversed, moves forward, engaging the head of a cartridge in the feed lips, inserting this into the chamber, then closing and locking the breech. Ejection is carried out in the same manner as in the Johnson rifle.

Summarizing, we find in the Johnson, a machine weapon so light in weight (12.3 pounds) as almost to place it in the shoulder-rifle class. The only comparable modern piece exhibiting certain parallel characteristics is the German Solothurn, M.34, (which, incidentally, weighs just twice as much). Carefully designed from the standpoints of mechanism, balance, and form to minimize undue vibration during semiautomatic fire and to achieve a degree of accuracy considerably above the ordinary, it exhibits in addition novel features in respect of its feed mechanism, provision for instantaneous barrel replacement, field stripping, etc., and appears a piece worthy of the traditions of American arms makers.

Ordnance Reserve

OBSOLETE TRAINING TEXTS DISCARDED

THE current publication and distribution of scores of new or revised training manuals by the War Department has focused attention on the great amount of training literature being produced by the Department to expedite the training of the rapidly expanding Army of the United States. These new or revised texts have replaced old texts which have now become obsolete. In calling attention to this fact, the War Department has again directed all officers to destroy old training texts as soon as new or revised texts become available, as directed by Training Circular No. 6, February 4, 1941. This admonition was issued because it was discovered that many copies of obsolete texts are still to be found in some headquarters' files and in the personal files of many officers.

At the same time, the War Department reëmphasized the necessity of officers familiarizing themselves with latest training aids. In order for them to be in step and to be assured that they are following latest War Department doctrines, it is of especial importance for all officers to know of the latest training texts, training motion-picture films and film strips, and training circulars.

Training texts include all War Department publications concerned with training. They are now being issued in the form of field-service regulations, field manuals, and technical manuals. The present training regulations, training manuals and technical regulations eventually will be eliminated by the inclusion of suitable material in other training documents.

Training motion-picture films and film strips are being developed almost as rapidly as the production of new or revised training literature. To date, more than fifty training films in sound either have been produced or are in process of production, while nearly twenty-five silent films are available for training purposes. The films depict diversified training subjects from bombardment of airdromes to care of animals.

Training circulars, which are now issued from time to time, promulgate new doctrines for test. They also include minor changes in field manuals and technical manuals or other training literature, and disseminate War Department training policies. An up-to-date list of training texts, films, and film strips is contained in FM 21-6, "List of Publications for Training." This basic field manual was issued on October 1, 1940, to supersede FM 21-6 of January 2, 1940. It also describes the scope, texts, numbering, changes, distribution and other information concerning field-service regulations, field manuals and technical manuals, besides detailing the scope, numbering and distribution of training circulars.

Modernization of much of the Army's present training literature is being undertaken at the War Department by a special manual project established in 1939. During 1940 alone, a total of 108 new or revised training texts were produced under the direction of this project.

A NEW MANUAL ON MILITARY COURTESY AND DISCIPLINE

THE War Department has announced the publication of a new manual entitled "Military Courtesy and Discipline" which gives additional stress to the need for independent thought and action by the American soldier under field conditions. In general, the 40-page manual restates in new language well-tried basic principles of discipline and initiative that always have been associated with the American character. Included also are some distinct departures from old custom that are based on considerable thought since the World War. The necessity for these

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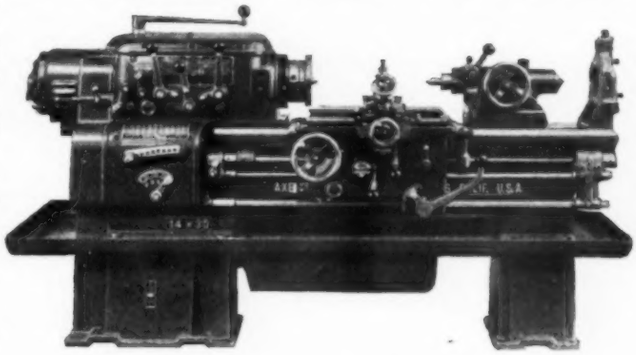

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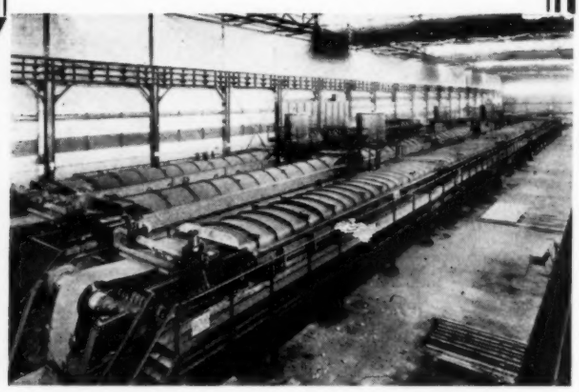

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changes has been confirmed by recent experiences and operations of the European war.

In this manual, the War Department also gives for the first time general rules for the display of the national flag. Heretofore, rules governing the showing of the flag have been formulated by private patriotic organizations which in turn were guided by traditional usage. This usage is retained in the manual. There is no law or regulation nor a specific official source dealing with this subject, and, as a result, different parts of the country have developed different ideas on how the flag should be displayed. While the section on the flag lays down the rules to be followed by the Army, they may be followed also by civilians who desire uniform guidance on the subject. The new manual will be required reading for every officer in the Army. The section on customs of the service should be of particular interest and assistance to young officers and officer candidates.

The War Department herein emphasizes that harshness and arrogance are not the key to discipline in the United States Army. Discipline, says the new manual, must be built up on the intelligence, sportsmanship, individuality, and group coöperativeness of the man in the ranks.

"True military discipline," states the manual, "extends far deeper and beyond the mere outward sign. For example, proper dress and smartness of appearance, while desirable and conducive to good discipline, are not alone conclusive proof of *true* discipline. A more likely indication is the behavior of individuals or units away from the presence or guidance of their superiors."

In training troops, according to the manual, it will be borne in mind that "modern warfare requires self-reliance in every grade; individuals capable of independent thought and action, who are inspired by a distinct feeling that as an individual or as members of a unit they are competent to cope with any condition, situation, or adversary."

Acknowledging that there is "no perfect formula or single rule" for the attainment of discipline, officers and noncommissioned officers are directed to employ all types of military training which tend to develop a sense of duty, pride, responsibility, loyalty, morale, respect, confidence, initiative, and teamwork.

Cognizance is taken of the great number of selectees who are now joining the Army. The manual makes it clear that they are not expected to make a violent transition to army life. "It is essential," says the manual on this point, "to keep in mind that in our country the environment of the soldier may differ materially from that of his previous surroundings. To disregard the civil environment is a serious error. The necessary transition may be a slow laborious process, requiring infinite patience and consideration on the part of the leader."

Other excerpts on discipline follow: "Loyalty and respect are developed through mutual understanding and consideration, through fairness and justice, and by sharing dangers and hardships as well as joys and sorrows. . . . A soldier must be made to realize that all his acts are reflected on the unit to which he belongs. . . . Leaders must use their ingenuity to create opportunities which place responsibility on individuals appropriate to their training and grade. . . . Self-respect must be maintained at all costs. Corrections are made privately whenever practicable and are never personal or degrading in nature. . . . Young and inexperienced leaders must realize that while firmness is a military requisite, it does not necessitate harshness of manner or of tone. . . . Superiors are forbidden to injure those under their authority by tyrannical or capricious conduct or by abusive language. . . ."

Line drawings illustrate the rules for saluting in the section on military courtesy. Some changes dictated by common sense and the exigencies of mobilization training are noted. For instance, units of men riding in military vehicles are not required to dismount when the National Anthem or To The Color is sounded. The men remain seated at attention while the person in charge dismounts and renders the salute. This may be illustrated by the example of a convoy arriving on a post from field exer-

cises at Retreat. Before all the men could dismount, form and come to attention, the ceremony would probably end. Instead, the convoy is halted, the men remain seated at attention, and their officer steps out of his vehicle to salute in the direction of the flag or the music. Individuals riding in a passenger car or on a motorcycle should dismount and salute.

Another departure from previous regulations makes it unnecessary for a soldier or an officer to salute a superior outside the confines of military posts. The salute is authorized, but not required, unless the individual is addressed by a senior entitled to it. Soldiers at meals in mess halls no longer stop eating and sit at attention when an officer enters. They will remain seated at ease and continue eating unless the officer directs otherwise. An exception is when a soldier is addressed while eating. He ceases eating and sits at attention until the conversation ends.

The basic rule for the display of the flag is that the union of stars should be to the observer's left when it is hung from a wall. On a rostrum the flag should be displayed above and behind the speaker's stand. Suspended across a street, the stars should always point east or north, as the case may be, and not west or south. The manual states that the flag should never be used as a drape for a platform, desk, chair or bench.

Copies of this new manual: "Basic Field Manual—Military Courtesy and Discipline—FM 21-50" may be obtained at 10 cents each from the Superintendent of Documents, Washington, D. C.

NEW POLICY ON ACTIVE DUTY

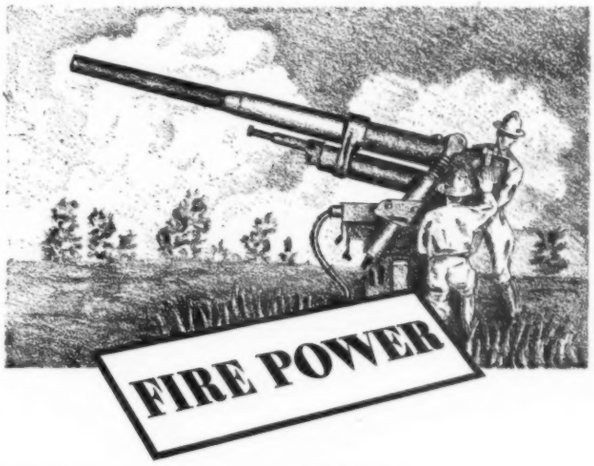
TO provide training opportunities for many Reserve officers who have not yet been ordered to extended active duty during the present emergency, a new policy on extension of tours of Reserve officers now on such duty has been announced by the War Department. The new policy directs that not more than seventy-five per cent of Reserve officers now on duty with corps-area service commands and War Department overhead installations, and not more than fifty per cent of such officers now on duty in each regiment, separate battalion or company, or similar organization, may be continued on active duty for more than twelve months, except officers in the following categories whose tours may be extended without restriction:

(1) Officers, other than Air Corps, whose initial tours of active duty began prior to August 27, 1940 (date of approval of Public Resolution No. 96, Seventy-sixth Congress), who entered upon active duty with assurance that if their services were satisfactory their tours would be extended; (2) Officers called to active duty from the category of warrant officers and enlisted men, Regular Army; (3) Officers on duty with a service, the Signal Corps, the Reserve Officers' Training Corps, or the Air Corps, but commissioned in an arm or service other than the Air Corps; (4) Officers on foreign service, or who have heretofore consented to extension of tours of active duty for the purpose of entering upon specialized duties; (5) Officers requested by an assignment authority for the purpose of assignment to duty, during the period of the extension, with a service, the Signal Corps, the Reserve Officers' Training Corps, or to fill a specialized position for which there is no other readily available and qualified Reserve officer. Applications for extension of tour require the approval of all commanders concerned.

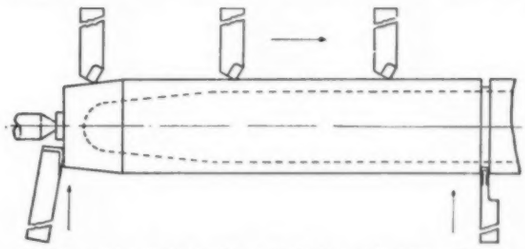
The total number of Reserve officers on duty with any organization or installation on July 1, 1941, when the new policy takes effect, will be used to determine the percentages of those officers whose tours of active duty will be extended for an additional twelve months.

The War Department announced on December 26, 1940, that with the exception of Reserve officers whose current assignments are based on agreements for extension of their tours of active duty, no other Reserve officers, except Air Corps, Medical, and Dental officers, will be continued on extended active duty without their consent.

H. E. A.



Begins in the Machine Shop



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From the Record

The following quotations are from addresses or writings of recognized authorities and comprise a cross section of opinion on subjects closely allied to the national defense. They have been selected for publication as being important and timely. Army Ordnance *thus hopes to acquaint readers with qualified views regarding various phases of industrial preparedness.*

The Defense Contract Service

NOTHING short of the practical limit of our available productive capacity is sufficient for the defense job we have now undertaken. It is imperative that prime contractors subcontract more of their work wherever such procedure will hasten deliveries. Every manufacturer, large and small, who has suitable machinery that is now idle, or that can be made available, must be enlisted in defense production.

In his budget message to Congress at the beginning of this year, President Roosevelt estimated that we had a $28,000,000,000 defense program. Whatever sum the Congress appropriates to carry out the policy of increased assistance to those nations whose defense is essential to the defense of this country will be in addition to that.

The magnitude of the job is hard for anyone to grasp. It is indicated, however, by comparison, for instance, with the estimated wholesale value of all passenger cars and trucks turned out by the automobile industry last year—$3,184,959,808.

Of necessity, initial orders had to be placed with companies having readily available facilities together with managerial and engineering staffs and the experience necessary to translate contracts of such size into equipment, man power and materials. That every available plant may now be brought into the program swiftly and systematically, I would like to make this suggestion to every factory owner who believes he is equipped to handle a defense contract or subcontract: Write or go to the regional office of the Defense Contract Service at the Federal Reserve Bank or branch bank which serves the region in which you live. Your own bank can tell you the location of this Federal Reserve Bank or branch bank.

The Defense Contract Service has been established by the Office of Production Management, in coöperation with the Federal Reserve System, to assist the Army and Navy in bringing every available manufacturing facility into the program. It will serve as a clearing house of information for manufacturers seeking prime or subcontracts, for district procurement officers whom the Army and Navy have had in the field for many years, and for prime contractors who need to subcontract more of their work to speed up deliveries.

The owners of plants that have usable basic machine tools and other equipment should tell their regional office of the Defense Contract Service about them. These regional offices will put together and expand the many valuable plant facility surveys already undertaken by national, state, and local organizations. They will tell prospective contractors and subcontractors what the Army and Navy want to buy; whether the plant facilities available can handle prime or subcontracts; where prime contractors can find needed subcontractors, and where potential subcontractors can find prime contractors with work which they could do.

The Defense Contract Service offices already have staffs available to advise on contracting and financial problems, and they are setting up technical staffs to aid contractors and prospective contractors on engineering problems. Manufacturers will serve the country and themselves by making the fullest

possible use of this service. Spreading the defense job into every available plant is the best possible way to speed up urgently needed deliveries now and to increase total production.—*William S. Knudsen, director general, Office of Production Management.*

THE SERVICE JOURNALS

IT is in the realm of information, of factual information, that the service journals are so important as what I might term an arm or branch of our public relations. Between the Armistice of 1918 and the commencement of the war in September 1939, it was the business of service journals to expose the fallacies of pacifism that befuddled the country, to emphasize in and out of season the necessity of adequate preparedness, and to demand that our military, naval, and air forces be not cut to further weakness. The fight was discouraging. It was the grimmer because of the necessity of maintaining morale in the services under conditions which made the man who wore a uniform a war monger and a militarist and which held the manufacturer of munitions up to public scorn as a "merchant of death."

Perhaps these diatribes were the natural disillusionment of war, and particularly, as events were to prove, of the ineptness of the slogan which ballyhooed that conflict as a "war to end wars." It was a psychosis that gripped the country—a psychosis that, despite wars and rumbles of wars abroad, welcomed the scrapping of 465,000 tons of new warships which would have brought to us the mastery of the seas, and which was to reduce the Army to a mere 117,500 men. Rudely awakened from this dream of eternal peace, we recognize now that the voice of the service journals was a voice crying in the wilderness of popular disarmament. Yet even in the years that have gone, that voice had potency—potency among the far-seeing of the Army and the Navy and the thinking citizens who refused to believe that history would not repeat itself, and that the inevitable conflict of economics and races would not come again. It was this group which relied upon the service journals to supplement their efforts for reasonable armament and for a preparedness which would assure at least a foundation for the strength we must have in order to resist an assault by an aggressor nation. For this preparedness planned and schemed the hard-working and studious officers of the high commands and schools, and, indeed, all the components of the Army and Navy. Valiantly the service journals gave them support. These journals published their views, commented upon them, brought them to the attention of the daily press, and employed other means to din them into the public ear. Thus, while pacifism was rampant, while there was great public acclaim for such antiwar plays as "What Price Glory," there was being built a dam of understanding of the country's helplessness which stemmed the stream for disarmament by example. It took time to reform the front, but that there was progress we find from the complaint against "military propaganda" from such an ardent pacifist as Oswald Garrison Villard. If, he said, subtle penetration of our civil life by the military continues unchecked a few more years, we shall be well along the road to the "nation in arms" which the dictators abroad have now achieved. It is regrettable this opinion of Mr. Villard had so little basis in fact.

The fundamental requirement of the service journals is accuracy. Because they are run by human beings, it is natural that occasionally they make mistakes. But you may depend upon it that in the next issue a mistake finds correction, and the correction is emphasized.

To sum up, the independent service journals are peculiarly fitted to assist in reaching the public by explanation of official policies and orders, and in indoctrinating military groups in order that its individuals may be fortified with accurate and strong arguments for dissemination in their own localities.—*Col. John C. O'Laughlin, publisher, the "Army and Navy Journal," Washington, D. C.*

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Book Reviews

PAN AMERICA—A PROGRAM FOR THE WESTERN HEMISPHERE. By Carleton Beals. Boston: Houghton Mifflin Company. 517 pp. $3.

IF THE value of a book were to be set merely on the accumulation of facts within its covers, the present work of Mr. Beals would rank very high. His coverage of the economic positions and the recent historic events of most of the countries of the world is extraordinary. It is a vast storehouse of data that lies behind the terrific struggle of the nations for self-sufficiency and control of the material resources of the world.

The book is not really a volume on Pan America. The countries of the American Continent are scarcely mentioned in the first 300 pages. It might well have been divided into two books with "Perfidious Albion" as the title of the first—and that is just where this reviewer differs with the author in the long-range interpretations, although agreeing on many short-range views.

In careful detail, Mr. Beals traces the private world monopolies which the British Government supported by force in rubber, jute, tin, shellac, tea, bismuth, nickel, zinc, and other materials. He views the British navy as protecting the little tugboat of the Netherlands, with a population of 8,000,000, towing behind it the East Indies with 61,000,000 inhabitants and an area 60 times greater than the mother country of Holland. In those islands of the East Indies was an exploitation which, in the words of the author, was "ruthless, without mercy." It brought an annual net profit of $280,000,000 to a very few Dutch imperialists linked in the British-Dutch monopolies, while at the date of the Nazi invasion of the Netherlands, 2,000,000 of the 8,000,000 inhabitants of Holland were on a government dole.

In all these things there is every element of truth. But in the opinion of this reviewer all that, and even more, does not point the final answer. It is true that the world monopolies of England prevented Germany, a country of 66,000,000 ambitious and clever people in an area smaller than the State of Texas, from having a share in the natural resources of the world except through a costly English-dominated middleman system. It is also true that the English- and French-dominated League of Nations crucified every nationalist right that interfered with the private monopolies of the few of their own nationals.

But, granting all of this, what is the answer? Does the answer lie in the defeat of England as a nation or in a German victory? The author tabulates the crimes of England and of the wretched governments the French people have permitted to be imposed upon themselves under the name of democracy. But tabulation of the crimes of a nation does not give the course of history any more than the crimes of the thief on the cross at Golgotha indicated his final place in history. As *The Sign* has expressed it, while England took the diamonds of the Boers, even her own people at home and her writers, like Chesterton, could lift up their independent voices against it—something that in Russia or in Germany or in Italy would have meant the dungeon or death.

This reviewer agrees with Mr. Beals that an old world is dying, that a new age is opening before us. But he can see only a great loss of the tremendous gains of the last seven centuries if we should make governments into single-purpose individuals to prevent crimes by crushing out individual will and freedom. The medicine would be more horrible than the sickness.

Mr. Beals misses the point entirely in thinking that substitute materials and Pan American trade will produce an America uninterested in the peoples and products of Africa, Europe and Asia. That is a doctrine of racial nationalism—a doctrine that is now dying. Mr. Beals has done a fine job of collecting facts, but he has misjudged the interpretation. G. S. B.

MANEUVER IN WAR. By Lieut. Col. Charles A. Willoughby, U. S. Army. Harrisburg: The Military Service Publishing Company. $3.

THIS is an interesting attempt to establish the principles of war by scientific proof. The evidence is sought in military history as "the laboratory of military science." Such an approach will be welcomed by engineers who are accustomed to deducing laws from experimental results. Nevertheless, the laboratory of history must be approached with definite reservations, since it unfortunately includes a multitude of intangibles. A diagram showing the composition of forces is not subject to variations. But in strategy, a diagram does not reveal the influence of weather, leadership, weapons, and morale on the relative strength of the forces in play. Nevertheless, if the correlation of facts is carried out objectively, and with absolute honesty, the scientific method applied to strategy will be valuable. And so it is here.

With these restrictive considerations, Colonel Willoughby has accomplished a first-rate exposition of the principles of strategy and maneuver. The evidence overwhelmingly supports the principles which the author establishes as basic in the successful conduct of war. The great leaders have achieved greatness because they practiced these principles. "Doctrine is developed on the battlefield by soldiers and reduced to formulas later on." Many attempts have been made to establish these "formulas." This is one of the most useful contributions to the study of strategy made by an American military writer to date. D. A.

WINGED WARFARE. By Maj. Gen. H. H. Arnold and Col. Ira C. Eaker. New York: Harper & Brothers. 260 pp. $3.

THIS is a timely and authoritative description of the weapons, tactics and policies of air power as a predominant arm in modern war. Its authors need no introduction as experts in their field. General Arnold is one of the Army's pioneer airmen; he was one of the first students of the Wright brothers; he holds pilot license No. 29 and expert aviator certificate No. 4; he is now Chief of the Air Corps and Acting Deputy Chief of Staff for Air. Colonel Eaker, as chief pilot of the QUESTION MARK, set a world's endurance flight record in 1929. In 1936 he made the first transcontinental blind flight. In 1939 he made two nonstop transcontinental flights, refueling in flight. He now commands the 20th Fighter Group, GHQ Air Force, Hamilton Field, Calif. Both authors hold the Distinguished Flying Cross.

In their text, the authors discuss the fighting airplane, its guns, bombs, cameras, engines and instruments. They then describe the new tribe of human beings with metal wings who have the power to protect our air frontiers. Every phase of aërial warfare is considered in this volume, including air bases, the organization of our air forces, squadrons, tactics, and strategy. There is a chapter devoted to experimental aviation, another to aircraft production, and finally to an adequate air defense. The *Stuka* bomber and the *Panzer* division are also described in their relation to the changing air-power scene.

Written in clear, simple language which any layman may readily understand, "Winged Warfare" should go a long way toward clearing up the muddled state of the public mind about mystery weapons, air power, air defense, and the relation of all these to our national security. C. A. L.

RIFLE MARKSMANSHIP. By William L. Stephens. New York: A. S. Barnes & Company. 86 pp. $1.

"RIFLE Marksmanship" is intended to shorten the route of beginners in reaching the top in rifle target shooting. It therefore describes the successive steps in the lengthy road to that high attainment. As a text for the beginner, the volume has the advantages of simplicity, clarity, and breadth. It is well illustrated by free-hand drawings showing the various components, shooting positions, and accoutrements with which the rifleman of today should be familiar.

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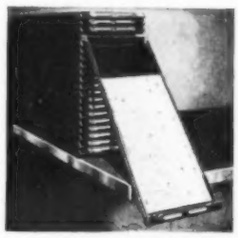

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The author is well known as an expert in his field. He has been actively engaged in caliber .22 rifle shooting since 1926 and has won many matches sponsored by the National Rifle Association. He was trained in the Army's Small Arms Firing School and holds a certificate of proficiency as an instructor. L. A. C.

BOOKS RECEIVED

EXTERIOR BALLISTICS—A Reprint of Chapter X, "Exterior Ballistics," and Chapter XII, "Bombing from Airplanes" from "Elements of Ordnance," 1938. Prepared under the direction of Lieut. Col. Thomas J. Hayes, formerly professor of ordnance and science of gunnery, U. S. Military Academy. New York: John Wiley & Sons, Inc. $1.

PROCEEDINGS—The Institution of Mechanical Engineers, January-June 1940, Vol. 143. London: The Institution of Mechanical Engineers.

WHITTLING BOY—The Story of Eli Whitney, 1765-1825. By Roger Burlingame. New York: Harcourt, Brace & Company. $3.50.

SCULPTURE IN ARMS AND ARMOR—A Picture Book. New York: The Museum Press, Metropolitan Museum of Art. $0.25.

THESE MEN. By Maurie J. Swetland. Harrisburg: Military Service Publishing Company. 312 pp. $2.50.

WHAT THE CITIZEN SHOULD KNOW ABOUT THE ARMY. By Harvey S. Ford. New York: W. W. Norton & Company. 223 pp. $2.

THEIR FINEST HOUR—First-hand Narratives of the War in England. Edited by Allan A. Michie and Walter Graebner. New York: Harcourt, Brace & Company. 226 pp. $2.50.

OFFICERS' MANUAL. By Col. James A. Moss, U. S. Army, Ret. Menasha: George Banta Publishing Company. 384 pp. $2.50.

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